GAS JOURNAL, AUGUST 31, 1938

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Editorial Notes

Air Raid Precautions

WHILE discussions are in progress with the Government with regard to Air Raid Precautions, a considerable amount of interest has been shown in the effect which the execution of the necessary works may have upon income tax and rating assessments.

Industrialists, no less than private citizens, would be more reluctant to carry out the wishes of the Government in these matters if the result was to be a substantial increase in their already heavy liability for rates and taxes. With regard to income tax, the matter will interest principally those who are liable to tax under Schedule A, since it might have been contended that the erection of such works as bomb-proof rooms and air raid shelters must have the effect of increasing the annual value of the premises upon which they have been constructed. In order that no such deterrent to the execution of these works may exist, a provision has been incorporated in the new Finance Act, which stipulates that in the assessment of annual value for Schedule A purposes no regard shall be had to (*a*) any room added to a building provided it is used solely for the purpose of affording protection from air attack, and is not occupied or used for any other purpose; or (*b*) any structural alterations or improvements made solely for the purpose of affording such protection. With regard to (*a*) it may seem odd that the new room may be used only for protection purposes, but it is easy to understand the practical difficulty which would arise in giving relief from tax in respect of a room which, while designed for air precaution purposes, was normally used as, say, a garage or office. This provision will not greatly affect the position of gas works, which are not liable to Schedule A tax. It will, however, be applicable to such premises as showrooms, managers' houses, and other properties which are assessed apart from the works.

It is hardly necessary to say that gas undertakings are assessed under Schedule B and that the assessment is based on the profits of these undertakers. The erection of new structures or the improvement of existing structures will not increase the Schedule B valuation. A gallant attempt was made, however, to amend the Finance Bill so as to allow all expenditure incurred in connexion with Air Raid Precautions to rank as an allowable revenue deduction. These amendments were opposed by the Government and therefore rejected.

In order to determine whether any particular work is work of a "revenue" or "capital" nature it will therefore be necessary to apply the general Income Tax Law. Some such expenditure must clearly rank as revenue, and in this we may include the purchase of masks and protective clothing, first-aid equipment, &c. Further it appears somewhat difficult to see how such structures as bomb-proof shelters and several other of the structural alterations and improvements which will be necessary could possibly be regarded as assets of a lasting nature which confer enduring benefit, such as to render the expenditure incurred upon them expenditure of a capital nature. It is to be hoped that the risk of war is transient and that better times will soon render such structures obsolete and useless. Much will, of course, depend upon the nature of the actual structures which are erected, but in any event the question as to whether the expenditure may be regarded as an allowable deduction is one that must be determined by the Income Tax Law as it stands to-day.

The problem in so far as it relates to any inter-connexion of distribution systems which may be necessary is even more difficult, and it may well be that this aspect of the problem will require further consideration. With regard to rating, the Government have introduced a Bill entitled "Rating and Valuation (Air Raid Works) Bill," which follows the form of the provision of the Finance Act to which we have referred above.

It provides that in ascertaining the rateable value, no regard shall be had to (*a*) any room added solely for the purpose of affording protection, or (*b*) any structural alterations or improvements made solely for the purpose of affording such protection. These provisions will not directly affect hereditaments such as gas-works, which are assessed on the profits basis; they may, however, be material in making structural valuation necessary for the apportionment of the cumulo valuation between various rating areas. More difficult ques-

tions may, though, arise as to whether any part of such expenditure should be regarded as tenant's capital. The purchase of respirators, clothing, &c., would appear to fall into this category, while other work of a structural nature might well be classified as tenant's working expenses.

The remaining question is whether any Government grant would be regarded as revenue and as such liable to income tax. This question, it is submitted, has already been decided in favour of the taxpayer by the Special Commissioners of Inland Revenue in the case of Unemployment Grants. Such grants, it was held, were not subject to income tax, and after this decision it would appear to be unlikely that any claim would be made in respect of grants in aid of Air Raid Precautions.

Impact Corrosion

THE scouring effect of streams and of intense rainfall is a well-established principle in geology. There is also a similar, but less rapid, effect from wind-action, particularly if small particles of sand are carried in the wind; the rocks of any desert show this sand-blasting effect. Designers of carbonizing plant know that corrosion is apt to take place where a stream of gas changes its direction while carrying particles in suspension. Cases are known of sections of hydraulic mains where the hot tar-laden gases have had a swirling motion being corroded so badly that replacement was necessary long before any such effect could be detected in straight lengths of mains. How far does the rain of falling drops in certain types of gas washing apparatus also set up corrosion?

We ask this question in view of certain work recently published by Professor G. Welter and Dipl.-Ing. Gockowski upon corrosion by the impact of falling drops. These tests employed a 3% solution of sodium chloride falling in the form of drops from a height of 1·5 metres and of 5 metres upon plates of several metals. The effect was compared with the corrosion produced in similar metallic plates that were only kept moistened, without impact. It was found in every instance that greater corrosion was caused by drop attack than by moistening. With a duralumin disc, for example, complete perforation occurred within 36 days with drop attack, but no such effect was produced by normal corrosion by moistening. The quantitative figures for loss of weight in grammes per sq. decimetre obtained after 36 days were as follows, the first figure in each instance being that of the moistened specimen and the second that of the specimen subjected to drop impact: Soft carbon steel, 5·01, 6·95; soft carbon steel, as rolled, 4·12, 6·14; duralumin perpendicular to direction of rolling, 0·033, 0·059; duralumin parallel to the direction of rolling, 0·0276, 0·0925. In addition tensile strength tests were conducted on one of the specimens after 3 weeks' exposure, which showed that the uncorroded specimen had an average breaking load in Kg. per sq.mm. of 34·9, the moistened specimen of 26·9, and the specimen subjected to drop impact of 22·1.

These experiments lead us to wonder how far climatic conditions are responsible for corrosion of structures such as gasholders, scrubbers, and steelwork generally. In a dry climate it is generally found that atmospheric corrosion is not so great as in a moist climate. Is this due solely to the moisture which condenses and dries off again, or can it be accelerated by the impact effect of the rain carrying corrosive substances from the atmosphere, either in the form of solids or of acid gases dissolved in the rain. It is commonly stated that iron does not rust above the dewpoint, but this is not generally true. In an ordinary room atmosphere an initially clean specimen will rust profusely at relative humidities far removed from the dewpoint, the attack commencing at sporadically distributed centres. This form of corrosion depends upon whether a certain limiting saturation is reached, which in general should be above 70%. An interesting fact is that this type of rusting is prevented, even in an atmosphere above 70% humidity, by suspending the metal in a muslin cage through which air is drawn on to the specimen, thus showing that suspended solid particles have an important effect. This type of rusting, however, is clearly different from that of true impact corrosion.

In corrosion in general important principles are that of a critical relative humidity, the protective influence of oxide films, the importance of disperse particles in the air, and the acceleration caused by impact of drops. There is another important principle in corrosion that might well be ventilated —namely, corrosion by badly-made coal gas. The researches which have been made in the National Chemical Laboratory at Teddington have disproved the view that carbon dioxide is necessary for the atmospheric corrosion of air and steel. For many years the view was held that carbon dioxide plays a fundamental part in atmospheric corrosion, it being supposed that soluble ferrous bicarbonate, by hypothesis the primary product, hydrolyzes to give ferric hydroxide with liberation of carbon dioxide, whereby a further equivalent of iron is attacked. So far from acting as a stimulant of corrosion, recent work at Teddington has shown that carbon dioxide, at concentrations in the neighbourhood of, and also considerably higher than, the normal atmospheric content has a marked repressive effect at ordinary temperatures. When corrosion has been commenced in the ordinary way, and carbon dioxide has been withdrawn, an immediate effect is produced, the rate of rusting immediately decreasing almost to zero. It is known, however, that when gas has been made by over-pulling retorts, the internal steel portions of gasholders are subjected to rapid corrosion. To what is this due? Has carbon dioxide an inhibiting effect at low concentrations and an accelerating effect at higher concentrations? Is it that SO_2 is drawn in with the furnace gases, but if so that constituent should be removed with the ammonia. To what is the internal rusting of gasholders and gas mains due? We dry the gas below the critical saturation value, and thus inhibit or at least greatly reduce the rate of corrosion attack, but what is the influence of carbon dioxide in the absence of water? If we dry gas and oil-film the holder, can we make gas by over-pulling and yet avoid corrosion? Low-temperature gas from certain processes, particularly those making low grade gas, and indeed most forms of low grade gas, have a certain similarity with the gases from over-pulled retorts. Many gas-works mix producer gas with their coal gas to bring down its calorific value. Will they have trouble in due course with internal corrosion of their holders and gas mains, (*a*) if they dry the gas, and (*b*) if they do not dry it?

Science and War

DURING the last year of the Great War the late Lord Moulton, Director General of Explosive Supplies, was President of The Institution of Gas Engineers, and in his Address to the Institution in June of 1918 he said: "No one has had such a unique opportunity of witnessing the response of the Industry to new and exceptional demands made upon it by reason of the War. Your Industry—typically peaceful in character and

aims—has furnished material for purely war purposes, without which it would have been impossible to maintain the fight. . . . Not only have benzole, toluole, and ammonia produced by it furnished the materials for our high explosives, but in the direction of other needs of very different nature it has given promise of similar usefulness."

We quote the foregoing in the light of the Presidential Address of Lord Rayleigh to the British Association for the Advancement of Science, in which he repudiated the contention frequently advanced that the scientific research worker has been primarily responsible for the development of the horrible aspects of modern warfare. The process of the Gas Industry is the scientific treatment of coal, and research has made possible the present high efficiency of this process. To-day more scientific workers than ever before are employed in it, and it may well be that in their investigations products may be found which could be used for destructive purposes. That is no reason for blaming the scientist. As Lord Moulton said, the Gas Industry is essentially peaceful in character; but in times of national defence it has proved itself an all-important instrument, and in the event of future war its services would undoubtedly be called upon once more and undoubtedly given to greater effect, such has been the scientific progress of the Industry during the years following the War.

"I believe," said Lord Rayleigh, "that the whole idea that scientific men are specially responsible is a delusion born of imperfect knowledge of the real course of the process of discovery;" and he went on to remark that in the course of systematic study of the chemistry of carbon compounds it was inevitable that the action of nitric acid on substances like benzene, toluene, glycerine, cellulose, and the like should be tried. No one could foresee the result. In the case of benzene, obtained from the products of the distillation of coal, we have nitrobenzene, the key of the aniline dye industry. Benzene is also the base of high explosives, which have proved invaluable in peacetime. "The trouble is," observed Lord Rayleigh, "that all the investigators proceeded in exactly the same spirit, the spirit, that is, of scientific curiosity, and with no possibility of telling whether the issue of their work would prove them to be friends, or dreamers, or angels. . . . Summing up what may be learnt from the experience of the past, I think we may say that the application of fundamental discoveries in science to purposes of war is altogether too remote for it to be possible to control such discoveries at the source. For good or ill, the urge to explore the unknown is deep in the nature of some of us, and it will not be deterred by possible contingent results, which may not be, and generally are not, fully apparent till long after the death of the explorer. The world is ready to accept the gifts of science and to use them for its own purposes. It is difficult to see any sign that it is ready to accept the advice of scientific men as to what those uses should be." For which reason we welcome the fact that the British Association has under consideration a division for study of the social relations of science which will attempt to bring the steady light of scientific truth to bear on vexed questions.

Gas Purification

In to-day's issue a contributor discusses modern developments in the purification of coal gas. His reference to the recent process of the Gesellschaft für Kohlentechnik, which is being tried out on a scale of 3½ million cu.ft. per day at the Kokerei Kaiserstuhl, is particularly interesting. This process is an improvement of an earlier one of the same Company which has been in operation at the Mt. Cenis coke oven plant for several years. As the hydrogen sulphide is absorbed in an iron oxide suspension, the hydrocyanic acid must be first removed by washing with a solution of ammonium polysulphide. The hydrogen sulphide is then absorbed by the iron oxide and the resulting sulphide oxidized by air liberating free sulphur. Sulphur dioxide produced by burning some of the recovered sulphur is added to the crude gas and combines with the ammonia to form ammonium sulphite which passes into solution on washing. By treating this solution with sulphur at an elevated temperature ammonium thiosulphate is formed. This solution is then treated with 60% sulphuric acid at 100° C. and yields sulphate of ammonia and free sulphur. The latter is filtered off and the sulphate of ammonia crystalized out in an evaporator. The process appears long and somewhat involved, but the costs are claimed to be similar to those obtained in oxide purification. In the same article mention is also made of a process of catalytic oxidation of hydrogen sulphide to sulphur trioxide and the absorption of this gas in the water resulting from the same reaction.

Ninety per cent. sulphuric acid can be produced by this process, which is carried out in a small and compact plant requiring little technical control. A small unit of this type is in operation at the Beckton By-product Works of the Gas Light and Coke Company, using the hydrogen sulphide gas from the sulphate of ammonia saturators.

Street Lighting Activities

The notices of "Gas Undertakings' Results" appearing in our pages have contained quite a number of references to substantial increases in the numbers of gas lamps in use. The Corporation undertakings of Chesterfield, Edinburgh, and Oldham all provide examples of healthy growth in this direction. It is a growth which affords the Gas Industry solid grounds for satisfaction, particularly as street lighting is a public service of ever-growing importance. The improvements which are constantly demanded it is in the power of the Gas Industry and the manufacturers of equipment to carry out, wherever and whenever the Lighting Authorities will empower them to do so. Long-term contracts with gas companies have been the means of bringing about very great improvements in street lighting in a large number of cases, but the problem of meeting the cost of providing up-to-date installations is still being faced in many quarters. Mr. John R. Buckley, the Chairman of the Oldham Corporation Lighting Committee, in a foreword to the annual report of the Lighting Superintendent (Mr. Charles Worswick), remarks that an important feature in the work of the Lighting Department during the past financial year is the progress made in improving the lighting in residential areas. The improvements which have been effected in recent years in the lighting of the main traffic routes has drawn the attention of the Lighting Committee to the need for reducing as far as practicable the disparity between well-lighted thoroughfares and those of adjoining side streets. However, "financial considerations are still retarding street lighting development on the lines indicated in the Final Report of the Departmental Committee of the Ministry of Transport on Street Lighting, and," Mr. Buckley goes on to say, "it is becoming a matter of urgency that the present state of affairs shall be met in some way by the Ministry. My personal opinion is that the Ministry should be solely responsible for the maintenance of the lighting of the trunk and traffic roads of the country." This is an opinion with regard to which Mr. Buckley is not likely to find himself standing alone. On the same subject, Mr. Worswick, in his report, points out that "to bring the street lighting of the borough into line with the Departmental Committee's recommendations would entail a large capital expenditure and a substantial increase in recurring expenditure for annual maintenance of the installation." At the same time, that a great deal has been done by the Committee in the matter of improving the lighting is shown by graphs accompanying Mr. Worswick's report. The first indicates the steady increase in the number of lamps (gas and electric) in the borough; the second shows that, as compared with 1924, the increase in candle power per head is 3·13 candles, while the decrease in expenditure is 13·07d. per head.

Personal

Newcastle Appointment

Mr. EDWARD CROWTHER, who is at present Chief Engineer of the United Kingdom Gas Corporation, Ltd., has been offered and accepted the appointment of Chief Engineer and Assistant General Manager to the Newcastle-upon-Tyne and Gateshead Gas Company, and will take up his duties on Dec. 1 next. Prior to his appointment with the United Kingdom Gas Corporation, Mr. Crowther was Engineer and Manager to the Salford Gas Department from 1934 to early 1937, before which he held a similar position at Bradford.

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Mr. J. H. BINGHAM, General Manager of Metropolitan Gas Meters, Ltd., and of Cheltenham Meters, Ltd., will sail for the United States on the *Aquitania* on Sept. 7, to attend the International Congress of Scientific Management, to be held at Washington. Mr. Bingham is a member of the Council of the Institution of Industrial Administration, and is Chairman of the Institution of Production Engineers.

* * *

With a view to strengthening their sales organization, the Cardiff Gas Light and Coke Company have recently appointed a Gas Sales and Publicity Officer. The first to fill this new position is Mr. RONALD H. BONE, whose first executive post was Sales Manager to the Eagle Range and Grate Company (Radiation Ltd.), where he made contact with the Gas Industry through the production and marketing of the gas-ignited domestic coke grate. He subsequently joined the Brockhouse organization as Sales and Commercial Manager of a department created to produce and market various gas appliances, later becoming General Manager of the Brockhouse Heater Company, which was formed to take over the business of this department. Chiefly concerned with the development of the gas-ignited coke grate, Mr. Bone has been responsible for the introduction of many other products, including gas-fired boilers, water heaters, and gravity-feed coke boilers.

* * *

Mr. CHARLES PAWSON has this month completed his fiftieth year in the service of Messrs. Geo. Bray & Co., Ltd., of Leeds. Entering the firm in his early 'teens, Mr. Pawson rose rapidly and became in turn Cashier, Works Manager, and Sales Manager, the position he now holds. Mr. Pawson was quick to see possibilities of developing the export trade and, having a natural propensity for languages, he soon began touring the Continent, where before long he became a well-known figure in gas circles from Spain to Poland. In America also Mr. Pawson did much to extend the sale of Bray burners. Throughout an active life, Mr. Pawson has found time to represent his firm at gas conferences in this country and abroad, and his many gas friends will join in wishing him continued health and service in the firm which for so long has been his great interest.

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Mr. J. W. HALSTEAD, Engineer and Managing Director of the Horsham Gas Company, retires to-day. As from Sept. 1, Mr. H. ROWLAND, Secretary of the Company, takes up the appointment of General Manager, while Mr. W. N. ALLWOOD becomes Works Superintendent.

Letter to the Editor

Water Softeners and Heaters

SIR,—I have read the article appearing in the current issue of the "GAS JOURNAL" regarding a new type of water softener, and in this connexion would like to advise you that "Ascot" gas water heaters types R.12/4 and RS.52/1 have been so designed as to reduce the possibility of scale formation to a minimum. As a matter of fact, in the design of the boiling water appliance type RS.52/1, we have achieved something hitherto unknown in this class of appliance, as it will deliver approximately 5,000 gallons of boiling water in a district where the water is comparatively hard as in London, before descaling is necessary. As the daily use of boiling water in a normal domestic household is not likely to exceed one gallon, the necessity for descaling will arise only at long intervals.

In this connexion I would also like to add that all domestic gas appliances receive maintenance visits from the gas company, and when descaling eventually becomes necessary it can be carried out at the time of one of these visits. You will see, therefore, that the comparatively high cost of a water softener cannot be justified by any saving in maintenance costs, except in very exceptional circumstances.

May I also mention that a water softener which complies with the stipulations set out in our booklet "Hardness of Water, its Bearing on Water Heating," and which is sold at a reasonable price, has not yet come to my notice.

I would like to add that the correct nomenclature of the "Ascot" boiling water heater is RS.52/1, and not R.S2.

Yours, &c.,

LEOPOLD FRIEDMAN.

Ascot Gas Water Heaters, Ltd.,
244, *High Holborn, W.C.* 1,
Aug. 23, 1938.

Forthcoming Engagements

September.

5 to 8.—A.P.L.E.—Annual Conference at Bournemouth.
8.—North British Association.—Annual Meeting at Largs.
10.—Junior Gas Association.—Joint Visit to Empire Exhibition, Glasgow.
12.—I.G.E.—Research Executive Committee, 2.30 p.m.
12.—L.C.C.A.—Technical Committee, 11.30 a.m.
13.—N.G.C.—Central Executive Board, Gas Industry House, 2.45 p.m. (Not 2.30 p.m. as previously announced.)
15.—I.G.E.—Finance Committee (instead of Sept. 13), 1.45 p.m.; Membership Committee (instead of Sept. 13), 2.15 p.m.; General Purposes Committee, 3 p.m.; Refractory Materials Joint Committee, 2.30 p.m.
15.—S.B.G.I.—Council, 2.30 p.m.
15.—Wales and Mon. Association.—General Meeting at Porthcawl.
20.—B.C.G.A.—Meeting of the Executive Committee, 2.30 p.m.
20.—I.G.E.—Gas Education Executive Committee, 2.30 p.m.
22.—I.G.E.—Gas-Works Safety Rules Committee, 2.30 p.m.
23.—I.G.E.—Joint Lighting Committee, 2.30 p.m.
26.—L.C.C.A.—Finance Committee, 10.45 a.m.; Executive Committee, 11.15 a.m.; Central Committee, 2.30 p.m.
28.—I.G.E.—Pipes Committee, 2.30 p.m.
30.—I.G.E.—Liquor Effluents and Ammonia Committee, 11.15 a.m.; Joint Research Committee, 2.30 p.m.

October.

1-4.—B.C.G.A.—Annual General Meeting and Conference at Brighton (for Programme see p. 34 of "JOURNAL" for July 6).
6.—I.G.E.—Research Executive Committee, 2.30 p.m.
7.—I.G.E.—Joint Committee on Complete Gasification Under Pressure (16, Old Queen Street, S.W. 1), 3 p.m.
7.—Southern Association (Eastern District).—Meeting at Gas Industry House, 2.30 p.m. Discussion on A.R.P.
10.—I.G.E.—Finance Committee, 1.45 p.m.; Membership Committee, 2.15 p.m.; General Purposes Committee, 3 p.m.; Benevolent Fund Committee of Management, 4.30 p.m.
11.—I.G.E.—Council, 10 a.m.
12.—I.G.E.—Board of Examiners, 2.30 p.m.
13.—Midland Association.—Autumn General Meeting, Grand Hotel, Birmingham.
18.—I.G.E.—Gas Education Executive Committee, 11 a.m.; Gas Education Committee, 2.30 p.m.
20.—Eastern Counties Association.—Autumn Meeting at Gas Industry House, 2 p.m.

November.

1.—I.G.E.—Council, The Institution of Mechanical Engineers, 9.30 a.m.; Council (continued), the Institution of Mechanical Engineers, 4.30 p.m.
1-2.—I.G.E.—10th AUTUMN RESEARCH MEETING at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W. 1.

News of the Week

A New Gas Main is to be laid from East Cross to St. Michaels by the Tenterden Gas Company.

New Carbonizing Plant is being built by the Heckington Gas Company. It is expected that the new works will be ready by November.

A Recent Issue by the Bedford District Gas Company of £56,530 4% redeemable preference stock, 1958, resulted in tenders being offered to the extent of £128,000. The highest price was £105, the average being £100 4s. 2d.

Because No Market for Surplus Gas from their coke ovens could be found, Mr. R. L. Angus, Chairman of Messrs. William Baird & Co., Ltd., iron and coalmasters, Coatbridge, speaking at the annual meeting in Glasgow on Aug. 26, said that plans for the modernization of Gartsherrie Iron Works and the erection of coke ovens there had been delayed. The dividend for the year is 16%.

A Visit to the Gas Pavilion at the Empire Exhibition, Glasgow, was paid by Miss Margaret Lockwood, the well-known film star, on Aug. 24, when she was received by Mr. David Lawson, the organizer, and inspected the various appliances. A large audience had assembled and she signed numerous autograph books. During the past week large audiences have witnessed demonstrations of continental cookery by Miss Zimmermann, of Radiation Ltd.

The Diamond Jubilee of the Firm will be celebrated on Sept. 1 by Messrs. Brotherton & Co., Ltd., the well-known chemical manufacturers. It was on Sept. 1, 1878, that the late Lord Brotherton began business as an ammonia distiller at Wakefield. The present Chairman is Mr. Charles Brotherton, J.P., nephew of the founder, and the Company now operates Works in Leeds, Wakefield, Birmingham, Liverpool, and Bromborough. Apart from a large home trade, the Company's products are exported to nearly every country in the world.

A Visit of the British Junior Gas Association to the Empire Exhibition, Glasgow, will take place on Sept. 10. On the following day there will be a tour of the Scottish lochs.

The Output of Coal in Great Britain for the week ended Aug. 13 amounted to 4,264,900 tons, compared with 2,452,900 tons in the previous week. The wage earners employed numbered 773,700 compared with 774,700.

As a Result of the acceptance by the Lyndhurst Council of a tender by the Southampton Gas Light and Coke Company, the gas lighting of the streets of Lyndhurst during the coming winter will cost less than the 2d. rate the Council had authorized for the purpose.

The Following Employees of the Folkestone Gas and Coke Company were among local drivers who received awards of the National Safety First Association on Aug. 25: W. E. J. Hall, W. J. Want, J. A. Wiles (gold medals, 10 years), W. R. N. Crooks (bar, 9 years), C. Fagg (bar, 8 years), A. J. Trott (diploma, 4 years, C. E. Godden (diploma, 3 years), and D. W. Eley (diploma, 2 years). The awards were distributed by Alderman A. Castle, Mayor of Folkestone.

As a Result of the Absorption by the Hyde Gas Company of the Dukinfield Gas Undertaking, important developments are foreshadowed. A new high-pressure main is to be laid along the tow path of the Peak Forest Canal from the Works at Hyde to Dukinfield. Gas will cease to be made at the Dukinfield Works, although the plant will be maintained in working order in case of emergency. Alterations are also to be made to the Dukinfield showrooms in King Street as soon as the necessary plans have been completed. Hyde has also taken over the Denton Undertaking and gas will be supplied from the Hyde Works, the Denton plant also being maintained for emergency. Reference to these amalgamations has already been made in the "JOURNAL."

All-Gas Radio an Accomplished Fact

In the course of their tour of an exceedingly interesting Radiolympia visitors were constantly pausing at one of the stands to inspect what is claimed to be the first entirely gas operated radio to make its appearance at the Radio Exhibition.

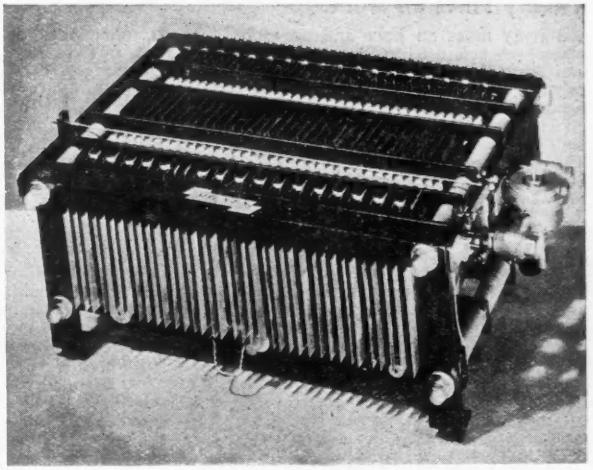
Our readers will recall that about the same time last year we drew attention to an interesting exhibit called the "Thermo-Charger," which was introduced by Milnes Radio Company, Ltd. The "Thermo-Charger" was stated to be a perfected version of the thermopile, which scientists had been striving to make a commercial possibility for many years. The appliance produced sufficient current to charge any low-tension accumulator by the direct action of a minute gas jet on thermo-couples. The makers at that time drew attention to the fact that the "Thermo-Charger" was forty times more efficient than any previous thermopile and would charge 2-volt cells from 2 to 3 ampères. The "Thermo-Charger" when used in conjunction with a Milnes H.T. supply unit, a high-tension battery that recharged from the low-tension accumulator, rendered the users of battery-operated sets independent of charging stations; in fact, they were able to enjoy all the convenience of all-mains radio.

The work has now been carried a stage further and batteries have been eliminated altogether. The all-gas radio is an accomplished fact. When we visited Olympia last Friday night we listened to a well-known make of four-valve set operating with complete satisfaction on the electrical energy supplied by the new Milnes unit. These compact units are available to the public for as little as four pounds.

The unit operates in an extremely simple fashion, and the method of its construction leaves no room for any mechanical or technical failure. A very short time after the gas supply to the unit has been ignited sufficient energy is produced to operate the receiver. In fact, there is a shorter time lag than experienced with most all-mains radios.

Every step has been taken by the designers to ensure that the unit is going to last and as an earnest of their confidence in their product they have undertaken to guarantee a working life of 5,000 hours, which is somewhere in the region of five-years' frequent use. Among the features that make for this long life one noted the fact that the metal junctions are heated by conduction from a central metal piece, the junctions being covered with protective sleeves. The gas jets are carefully regulated and the gas rate is controlled by a governor incorporated in the unit. A thermal cut-out has also been incorporated to prevent "feeding-back" if the gas supply were turned off when the unit was being used to charge an accumulator.

The following figures relating to the performance of the unit will be of interest to our readers. It is made in two sizes—*i.e.*, 4 and 8 watts. The gas consumption is 1 cu.ft. of gas per hour per watt output. Thus, with the four watt model one may listen-

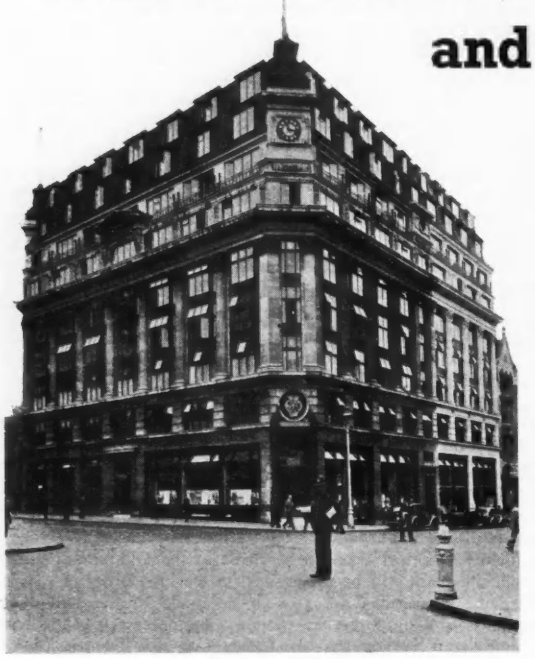


The Milnes Unit.

in for an hour at the cost of 4 cu.ft. of gas. One-third of the thermo-couples supply low-tension current; the remaining two-thirds supply current to a vibrator-convertor which "steps-up" the voltage to 150 at 15 to 20 milliamps for high-tension supply. The current, which is converted to a.c. for transforming purposes in the convertor is rectified again by the simple expedient of another vibrator at 180° to the original. The current from the vibrator-convertor is perfectly "smoothed-out," so that there is no interference with the operation of the set.

Fanum House has Gas Central Heating and Hot Water Supply

Another example of how an installation of Potterton gas boilers solved a difficult problem where space for the necessary plant was at a premium—this time at the fine Headquarters of the Automobile Association, known the country over as Fanum House, London.



Fanum House, London.

It seems a far cry from the passing of the Motor Car Act in 1903 to recent Road Traffic Acts—and farther still, perhaps, from the days when, in a little room in Fleet Street in the year 1905, the Automobile Association came into being to fight the cause of "This Motoring" which had startled the English countryside out of its customary calm. It was one of the provisions of that Motor Car Act which was primarily responsible for the formation of the A.A.—the section which made speed by itself an offence, irrespective of danger.

Twenty Miles an Hour.

Twenty miles an hour and no more. Never mind when or where. A measured furlong on a nice straight piece of road, safe and tempting to the motorist. Two policemen in plain clothes, one at each end, with stop watches—hiding. A third in uniform beyond the end of the measured distance. The trap was set for a rich harvest of fines, endorsements, even suspensions, for those who were caught breaking the law at 21 m.p.h. on the open road. That, together with the anti-motoring bias of many sporting members of the country bench, was what the A.A. set out to fight. From a handful of members and a few scouts on the Brighton Road, the organization has assumed the vast proportions which are familiar to every motorist to-day. At the present time every road of importance in the country is patrolled. A.A. road service is unsurpassed in any part of the world. There is a Fanum House in most of the principal provincial centres, with a day and night service at the London Headquarters. Even Continental travel is made easy by putting oneself and one's car in the capable hands of the A.A. From some nine hundred members in 1906, the half-million mark was reached almost exactly five years ago, while to-day the membership exceeds seven hundred thousand. Such truly phenomenal development, together with the continual increase in the services of the Association, has necessitated a corresponding increase in personnel. So, from that little office in Fleet Street from which Sir Stenson Cooke, assisted by one typist, ably piloted the frail barque through those early troublous waters, the London staff has grown to close on 700 and occupies the vast premises in New Coventry Street, W. 1, known as "Fanum—London."

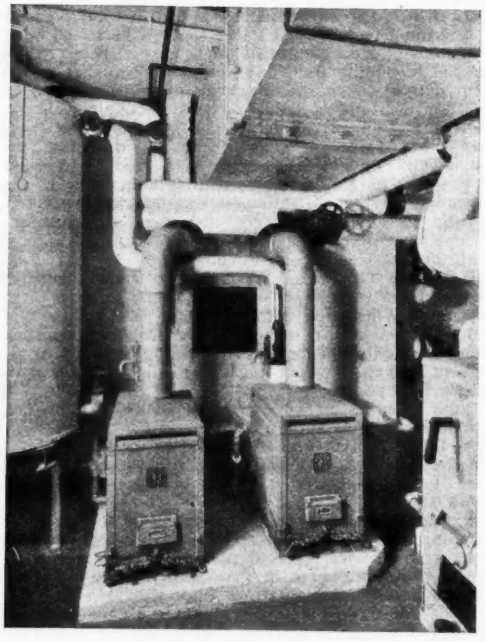
The Growth of Fanum House.

The first Fanum House was in Whitcomb Street and was taken over by the Association in 1909. Since then the organization, as it grew out of its existing accommodation, gradually acquired the whole building on that site, which was previously occupied by various other concerns. In 1925 the entire New Coventry Street and Leicester Square frontages were acquired, and a new building was erected to the design of Mr. Andrew Mather, F.R.I.B.A. This was considered at the time to be one of the finest buildings as well as the tallest (it has nine floors) in London, and it says much for the design that although thirteen years have elapsed since it erection it is still thoroughly up-to-date in both conception and accommodation. The building has been extended, in conformity with the original design, by the subsequent addition of two blocks—one fronting on Leicester Square and the other extending across the site to Whitcomb Street, adding respectively areas of 18,000 and 33,000 superficial feet.

The heating of the building when first erected was carried out by twin hand-fired coke boilers, having a B.Th.U. rating of 545,600 each and providing approximately 5,000 sq.ft. of radiation. On completion of the first extension of the building, when it was realized that additional boiler plant was necessary, a considerable problem arose—namely, that the boiler chamber was quite incapable of accommodating any further coke plant. In other words, the retention of coke firing would have entailed encroachment upon other parts of the basement and subsequent elaborate underpinning of that portion of the structure.

Gas Boilers Chosen.

The Association therefore decided to install gas-fired plant; and two No. 3 series Potterton "Rex" boilers—each of six sections



The two Domestic Hot Water Boilers, showing also a portion of the Storage Cylinder on the left.

and rated at 750,000 B.Th.U. per hour—were put in. In addition, a "D" series "Rex" boiler, in four sections, rated at 132,000 B.Th.U. per hour, coupled to a 200-gallon lagged storage cylinder, was installed to supply domestic hot water for the cloakrooms, &c. This apparatus was then serving some 80 points on the various floors—the staff at that time numbering about 500.

Further Additions.

The second extension of the building necessitated a further addition to the boiler plant, and it was found that the same boiler chamber was still capable of accommodating further gas apparatus by staggering the boiler units. A third heater was therefore installed to bring the total radiation up to 12,000 sq.ft. This was a No. 3 series "Rex" boiler in nine sections, having an output of 1,125,000 B.Th.U. per hour—giving a total output from the three units of 2,625,000 B.Th.U. Save under exceptional weather conditions, however, the large boiler and one or other of the smaller ones are capable of looking after the full load, thereby providing a useful standby plant in the second of the smaller units—a wise precaution in the unlikely event of breakdown.

At the same time the hot water supply installation was duplicated to serve an additional 40 taps in the new block. This installation, in addition to the usual thermostatic control, is provided with night valves to cut out the long secondary circulation—the skeleton night staff using a cloakroom adjacent to the boiler plant, thus saving fuel costs. The hot water supply is on gravity circulation.

The central heating circulation is assisted by twin pumps of a capacity of 150 gallons a minute, cross-connected so that either may be used. The plant is governed by rod thermostats with remote control in one of the offices, while the Committee Room has its own control by means of a magnetic valve on the wall. There is also an ingeniously concealed extractor fan to assist the ventilation of this room.

Ventilation.

The venting of the boilers is by means of metal ducting carried into the original coke boiler flue, which was specially adapted and extended to suit the new gas installation. The two hot water boilers and a small refuse destructor which is also installed in the boiler chamber discharge separately into the flue stack. Apertures have been allowed to permit of infiltration, as a result of which the system is entirely free from the slightest condensation.

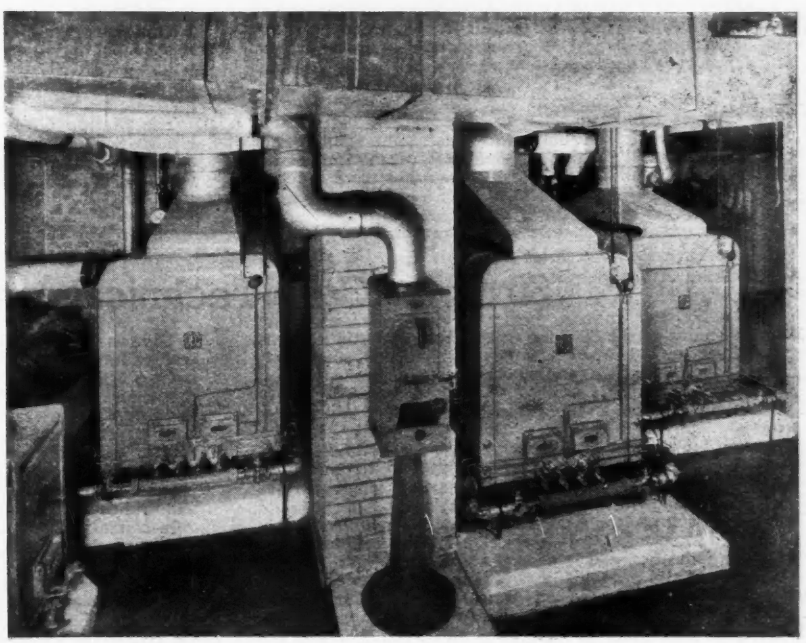
The gas supply is introduced by means of a 6-in. main and passes through a 6,000-cu.ft. per hour meter which is cross-coupled and by-passed. It is no small tribute to the adaptability of gas that so much apparatus has been accommodated in so small a space—five boilers, a 200-gallon storage cylinder, a refuse destructor, two pumps, a multitude of gas and water lines with valves, governors, and other controls, bulky flue ducting, not to mention a supporting column in the middle of the floor and the difficulties imposed by a tapering wall on one side and a flue-breast encroaching on another. Yet all the apparatus, though compactly installed, is easily approached for repairs or adjustments.

So far as the actual heating of the various offices is concerned, it may be mentioned that a neat and unobtrusive job has been made of the whole installation. Adequate radiator surface has been provided under windows in the principal rooms and offices, while in the public offices on the ground floor the heating surfaces

One of the General Offices.

are concealed behind grills let into the panelled dado or beneath the window shelves. This method is also adopted in the Committee Room and other administrative offices, where the radiators are invisible, and, in accordance of what is recognized and expected of gas service, operate quietly and efficiently without any other attention than the setting of the thermostat at the required temperature.

The A.A. have always maintained the reputation for thinking of original ideas and getting things done. In installing the most modern and efficient heating service in their headquarters at Fanum House they have—if we may be permitted to say so—only done what we might have expected of them. They have moved abreast, or perhaps a little ahead, of the times.



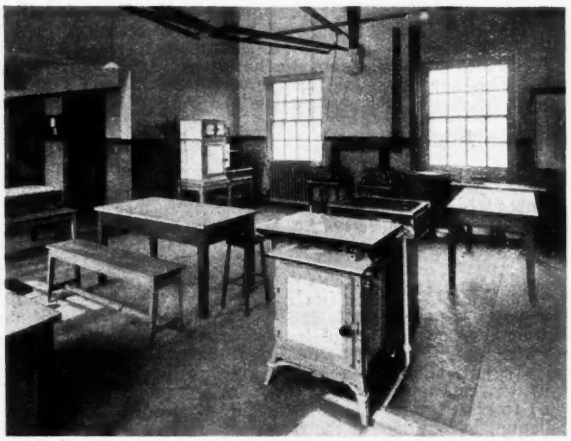
The three Central Heating Boilers at Fanum House, showing also the Sugg's Gas-Fired Refuse Destructor in the foreground. The circulating pumps can be seen in the left-hand corner.

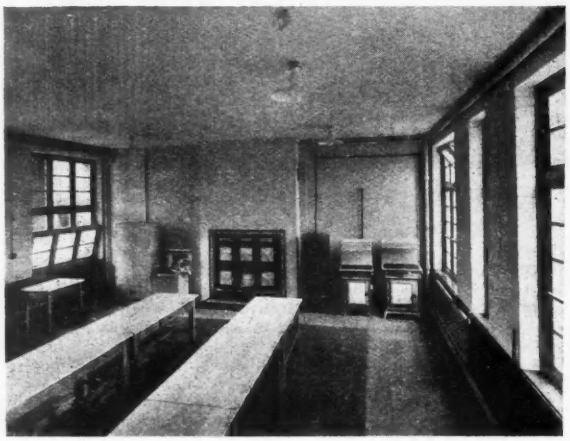
Gas Equipment

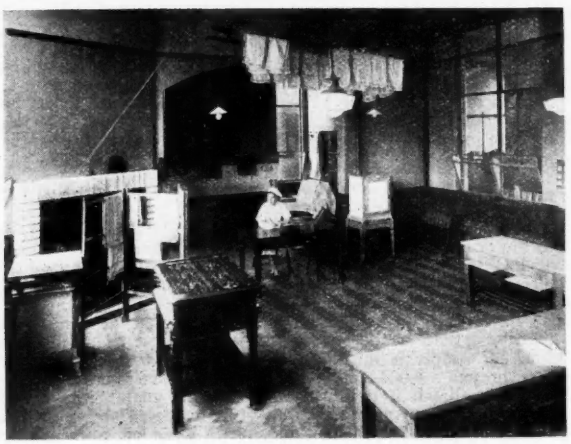
FOR

Domestic Science Centres

The accompanying illustrations show three Domestic Science Centres at Middlesbrough, where up-to-date gas equipment installed by the Middlesbrough Corporation Gas Department is largely used for various purposes, including cookery and laundry work.







On the left is the domestic science centre at the Whinney Banks School. This fine new school, built at a cost of £68,832, was opened in 1938. The total accommodation is 1,620. There are two domestic science rooms, each intended for 20 pupils and furnished on identical lines to provide for both cookery and laundry instruction, with tables arranged so that each girl can work independently. A larder and a store is attached to each room.

The gas equipment comprises: A "Sun" water heater, a "Jeroba" clothes drying cabinet, a washing machine, two cookers, iron heaters, and central heating. Incidentally, the whole of the hot water and central heating requirements of this school are provided by gas installations, for which purpose there are four Vesta C.2 boilers for central heating with an output of 3,200,000 B.Th.U. per hour and two Ideal 1GB7 boilers for hot water supply with an output of 198,000 B.Th.U. per hour.

Above (right) is the domestic science classroom in the Kirby Secondary School where there are three gas cookers, two wash-boilers, and two gas iron heating units. The central heating of this School is by means of an Ideal 3GB5 gas boiler with an output of 390,000 B.Th.U. per hour, and the hot water supply is by an Ideal 1GB7 boiler with an output of 148,000 B.Th.U. per hour.

The Marton Grove School (lower right) is another Middlesbrough School with an all-gas domestic science classroom. The equipment here includes: Two gas cookers, one gas hotplate, two wash-boilers, and three gas iron heating units.

Sir John Cass Technical Institute

The new session of the Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C. 3, which extends over about 36 weeks, will begin on Monday, Sept. 26, and students will be enrolled on and after Sept. 21.

The Institute provides evening instruction in pure and applied mathematics, physics, chemistry, biology, botany, zoology, bacteriology, brewing, petroleum technology, fuel technology (including coal carbonization and gas engineering), chemical engineering, metallurgy, assaying, geology, modern languages, arts and crafts, and tailoring.

The science courses are arranged to meet the requirements of those engaged in chemical, metallurgical, electrical, petroleum, and fermentation industries, and in general are held from 6 to 10 p.m. Day courses are also provided in physics, mathematics, chemistry, botany, zoology, metallurgy, and navigation. Full facilities are provided in well-equipped laboratories for special investigations and research.

The instruction in experimental science also provides systematic courses for the examinations of the University of London. These courses are conducted by recognized teachers of the University, so that matriculated students attending the same can be registered and examined as "internal" students of the University. The courses provided also meet the requirements of those preparing for the examinations of the Institute of Physics, the Institute of Chemistry, the Institute of Brewing, The Institution of Gas Engineers, the Pharmaceutical Society of Great Britain, and the City and Guilds of London Institute.

In connexion with the University courses it may be of interest to record that at the recent examinations of the University of London 30 students graduated in Science and in Metallurgy of which number 6 obtained a 1st Class Honours degree.

The Principal and Heads of departments will be pleased to advise intending students at the commencement of the session on the course they should undertake.

Some Wandering Thoughts About Gas and Gas-Making

By
A Slightly Cynical
Research Chemist

The other day the writer overheard a conversation between three generations in a tube train in London. The words spoken are unimportant as words, but they suggest that the attitude of many people to gas is in need of wholesome correction. The older generation expressed its fear of gas and gas appliances —" nasty, smelly, popping, explosive things, my dear! "— and still believed gas to be unhealthy. The younger generation despised gas as old-fashioned. It may well be that the experience of one of the speakers in this conversation went back over 70 years of the Gas Industry, and because " the use of history is to give value to the present hour and its duty," the mind of one hearer was sent wandering back through the past 100 years to reflect what changes in the mentality of the people had occurred that have had or will have an influence on the fortunes of the Industry. Such reflections are not altogether idle, for they may lead to a knowledge of directions in which to attack the great potential markets for gas that yet remain untapped.

Prejudice and Inertia.

The older generations will have remembered travelling on the " two-penny tube," and they will remember that the conditions were very different from those of the efficient underground railways of to-day. The gas fire of to-day is to its predecessor of 50 years ago as the underground railway is to the " two-penny tube; " but the recollection of past discomforts does not prevent the older generation from riding in to-day's tube trains. Why, then, should the remembrance of the smelling gas fires of the older days still serve to imbue the older generation with the idea that gas fires are unhealthy? It is a nice point. Is it the shortcomings of our propaganda? Is it not more probably due to the educational shortcomings of the older generation? Prejudice, too, plays an important part, and it is difficult to expect that same older generation to forsake the open fires with which they were brought up for the " new fangled " gas fire. One meets this attitude repeatedly, and it is worth while asking whether it is permanent, or whether it will die out with our generation. The older generation, too, is always governed in its actions by a certain inertia. As we get older we are all subject to this failing. A past Lord Falkland is recorded to have said: " If it is not necessary to change, then it is necessary not to change." In the sphere of law-making and of politics generally, no doubt this is a sound maxim; it is disastrous for industrialists—but it is unfortunately prevalent, even among industrialists. The Gas Industry must shake itself free from it.

Fundamental Changes in Outlook within the Nation.

Insofar as any lack of appreciation of gas appliances is due to ingrained prejudices, we can do nothing, and, indeed, nothing need be done. The passage of the years takes from among us those who are averse to change, and replaces that generation by the young, who are traditionally ready to try new things. The fundamental changes that have occurred since grandma was a girl and grandpa wore his cravat in the City are in two primary directions. One of these is in the far greater attention paid to health. The other is in the desire for less work and more leisure. The writer believes that both these fundamental changes are fighting the battle of gas as against the older prejudices.

(1) Health.

The " man-in-the-street " to-day is probably better instructed in elementary medical matters and hygiene than was the majority of the medical profession of 100 years ago. The result has been legislation in some directions and popular movements in others. Professor J. C. Drummond recently gave a series of Cantor lectures on the history of nutrition, and it is worth while illustrating the change in this primary direction of the outlook upon health by three instances from these lectures.

The Gas Industry was already established by 1839, and at that date the first artificial feeding bottle for infants was introduced. Professor Drummond thus refers to the occasion: " The new apparatus was regarded as a great advance. One of the hospitals in Paris tried it for their orphans. The results were regarded as promising. Of 372 children 'nourished by hand through a suckling bottle' only 297 died." These were the standards of infant mortality of the period.

The standard of foodstuffs in the 1840's is shown by the methods of the milk purveyors in towns: " The conditions under which the cows were kept were appalling. The byres were dark undrained sheds or underground cellars in which the wretched animals spent the greater part of their lives without exercise or fresh air, standing ankle-deep in manure and filth. They were fed on hay, turnips, and brewers' residues. . . . No words can describe what was sold by the 'dairies' of London in the 'forties. The toll of disease and death, especially among the young, must have been terrible: particularly as it was a time when the artificial feeding of infants on cows' milk was beginning to become popular."

Finally, the change from stone-ground flour about 1885 to roller-ground with removal of the germ, is thus described: " From this time dates the working class diet of (white) bread, margarine, jam, tea, and fish and chips, which so undermined health that when the Great War began and the services of every able-bodied man were required, the recruiting offices were staggered by the proportion of men unfit for general service."

The significance of these three flashes into the diet of the nation within the lifetime of the Gas Industry is that they show a progressive change in the mentality of the masses. The conditions of the 1840's are absolutely unthinkable to-day. It was the realization that we were rapidly becoming a 100% C3 nation in 1914 that brought about the great change in our attitude towards health. This change appears likely to go still further. We are beginning as a nation to protest against the unclean atmosphere that we are called upon to breathe through the retention of the open fire. Just as legislation has been called upon to deal with foodstuffs, is it not likely that this century will see legislation to purify the atmosphere we breathe? It is impossible to conceive of anything amiss in the hygienic standard of modern gas appliances, provided that they are treated properly by consumers. Admittedly, the conditions of use of many cookers are susceptible of improvement, but that is a matter of educating the housewives in the care and maintenance of their appliances.

The future of the Gas Industry must be visualized in perspective against the past development and in the light of the conditions under which that development has taken place. From the point of view of health, there can be nothing but optimism for the future. Gas may be fairly claimed to be the ideal fuel to suit modern health conceptions. Our research must be towards retaining and even extending that claim. Our propaganda should take this health movement as its focus and should demonstrate in the clearest possible way, from every hoarding in the country, how vast is the contribution that the Gas Industry has made, and will make, to the national health. Just now health and physical fitness are the concern of the public and of our rulers. Advertising is at its most effective when it is related to the affairs of everyday life. We can afford to wait for the hide-bound prejudiced to disappear in the course of nature, provided that their successors are fully acquainted with the value of gas to the nation and to the individual.

(2) Feminine Leisure.

Their successors! The successors to the old people are these younger generations who are so fully alive to problems

Thousands of tenants in Municipal Estates are supplied with a constant Hot Water Service to Bath, Basin and Sink by EWART Multi-point Heaters at minimum cost.

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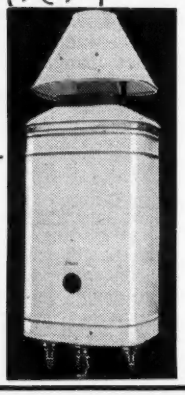

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308

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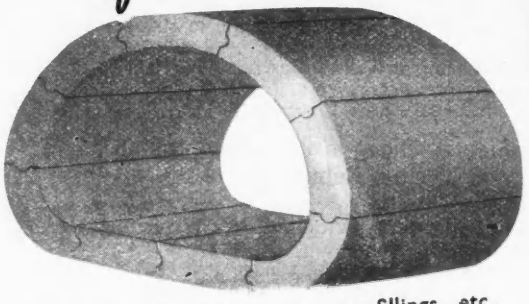
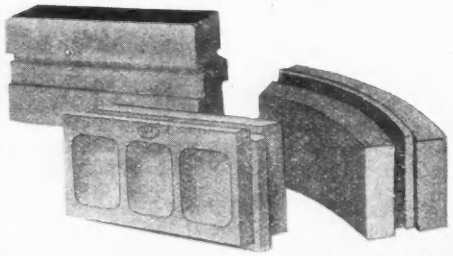
For the Gas Industry

Retort sections and special shapes for horizontal and vertical installations can be relied upon to give trouble-free and economic service when made in "BLUEBELL" 95% Silica material.





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We are exhibiting at the Empire Exhibition, Glasgow, May—Oct., 1938, STAND No. 55, Palace of Engineering

JOHN G. STEIN & Co LTD BONNYBRIDGE SCOTLAND

of health and fitness and who can for the most part be reached through those channels to which reference has just been made —and through one other. That other is very important indeed; its source lies in the demand for leisure and relaxation on the part of the women of the country. One effect of the entire freedom between the sexes that has been brought about by the War is that women of all classes are no longer willing to stay at home. Girls of the classes who would have been expected to provide the raw material for match-making mammas in grandma's days now start out in the world on careers. Pope's couplet that:

> " Men—some to pleasure, some to business take,
> But every woman is at heart a rake "

is less true to-day than it was formerly, for the women, too, take to pleasure or to business. The net effect from the Gas Industry's angle is that those women, whether married or single, who take to a career—and a good many others—have no time and less desire to do housework. Gas is the great labour saver in the home.

Domestic service as a career for working-class girls has so disappeared that many households even go as far afield as Austria and Germany for their domestic help. Gas enables a household to be run without a maid, especially when combined with electricity for duties that require power, such as operating the vacuum cleaner. Power is the field for electricity; heat, the field for gas; lighting may be the province of either. A surprising amount of the labour of a household is due to (*a*) sweeping carpets and (*b*) the dirt and dust and cleaning-up consequent upon the use of a coal fire. To the sophisticated moderns, the transition from a coal fire to a gas fire should be natural.

There is, however, a large number of women who have no career, or who have given up their career on getting married. These women, also, take advantage of modern ideas and inventions. In grandma's youth there was no relaxation during the day other than social intercourse and reading. The world was a stay-at-home world. Since then the cinema has provided for the leisure in the afternoon, and the formerly stay-at-home women flock to the " Palaces "—because " every woman is at heart a rake." There are bridge parties for the middle-classes, also. Sport, too, takes its place in the day's activities. The effect from the gas angle is that women require appliances which enable them to get the day's work done within a couple of hours in the morning; that will enable them to cook quickly when needed and without having to wait for the fire to burn up for the oven to get hot; and fires that will not require troublesome relighting when left unattended for a few hours. Gas, again, provides all that is necessary.

The Outlook of the Coming Generation.

These thoughts might lead to complacency, but they must not be allowed to do so. They are important as indicating the direction of advertising that would be effective; but there is much beyond salesmanship if the Gas Industry is to take advantage of changing social conditions and of the increasing medical knowledge among all classes of the nation. To illustrate this, let us recollect for a moment the conversation that the writer overheard. A grandson still in his teens expressed loudly the opinion that gas fires in the bedroom were unhealthy, and said that although he had one in his bedroom, he would " so much rather do as Smith Minor does and have a . . ." Many people are disposed to believe that Smith Minor's opinions are important. Let us dispossess ourselves of the idea that it matters two hoots what Smith Minor thinks. Smith Minor and his like are without knowledge of the ways of the world. Their opinions on appliances are about as useful as their grandfather's past ambition to be an engine-driver—and for the same reason. Grandfather in the mass could not be an engine-driver because stupid economic conventions prevented the work from being sufficiently lucrative. In exactly the same way, when he grows up Smith Minor and his like will discover that the fittings of his house will be (1) dictated by Mrs. Smith Minor, and (2) even more dictatorially imposed by those same economic laws of which at present Smith Minor knows nothing.

The Economics of Displacement of Coal by Gas.

In plain English, the domestic appliances of the future will be selected to conform with (*a*) the needs and habits of the feminine population, and (*b*) with the pockets of the male population. Let us not forget that 80% of our population have an income under £5 a week and 60% under £3 a week. These people have only a certain fixed amount to spend on their fuel, and even if they have a few shillings more, they can find other uses for it than paying additional sums for gas or electricity as compared with what they would spend on coal. The moral is clear, and this conclusion seems to the writer to be of fundamental importance. It is that the whole habits of the population are changing in a direction that will predispose them to use gas and electricity in place of coal. There are certain appliances such as the hot water boiler in which coke would be equally welcome and cheaper. It is possible for combined coke and gas fires to be designed which give the advantages of both. The basic fact is that these tendencies cannot be translated into terms of gas consumption unless the economics are sound. For that reason we need not worry if Smith Minor likes an electric fire, or if his sister admires the electric cooker. Hard economic facts, entirely apart from other considerations, will prevent any considerable domestic extension of electric appliances in most houses.

It is certain, however, that the great task of the future is to reduce the price of gas so that gas can be used to the exclusion of coal. The commercial staffs of the Industry, by skilful propaganda, can help to induce the frame of mind that predisposes people to escape from the dirt, smoke, and work of coal fires by installing gas appliances, but their efforts will be largely wasted unless the price of gas (and incidentally of the gas appliances when payment is spread over the necessary period) is such that the economics are sound for those who earn less than £5 a week.

The Problems Confronting the Gas Engineer.

Gas engineers must ask themselves why the cost of gas is so high. Is it because our manufacturing methods are out of date? For 100 years the Gas Industry thought in terms of the horizontal retort. During the last 30 years the only advance that has been made has been to turn that retort on its end, and apparently without making any appreciable contribution to the cheapening of the cost of gas per therm into holder. The horizontal retort to-day makes gas at much the same price as other known systems of gas manufacture. We buy a ton of gas coal containing perhaps 300 therms of heat units. We convert it into gas, of which we obtain about 80 therms, including some water gas from steaming verticals. Then we have 20 therms of tar, and the bulk of the coal is produced in the form of some 170 therms of coke. If with an efficiency of 80% we convert this coke into gas sold at (let us say) 5d. a therm, its value would be over 56s.; as coke it requires a special organization to market and deliver it; as gas it would be handled by the existing organization. Nevertheless, the value at the works put upon the coke is far less than 56s. per ton of coal carbonized. We sell our coke much too cheaply compared with its thermal value expressed as gas; alternatively, we have yet to devise a gas-making method which shall take advantage of the therms in the coke that can be converted usefully into gas.

The writer would appeal to gas engineers generally, whether they are on the manufacturing or the constructional sides, to get away from convention and consider this matter of cheap gas *ab initio*. We seem to be bound by many conventions in regard to the quality of gas, principally because the appliance makers have designed their present very efficient apparatus to use the gas we now make. If we found gas of quite different characteristics to be considerably cheaper to make or, which is really the fundamental point, cheaper for the consumer's pocket, we should make it and get the appliance makers to use their wide knowledge and experience to design apparatus to suit the characteristics of the new gas. In doing this it may be necessary to discard our convention that a gas retort shall consist of a " long hole " placed at any angle from the horizontal from 0° to 90°. It may be that something entirely new is needed. Have we another Livesey, another Newbiggin? Have we a great gas engineer who can revolutionize gas practice in the light of modern requirements and so enable the Industry to take advantage of those new modes of life and new ideas that are stirring in the world of 1938?

We say that 100 therms of gas are equal to 1 ton of coal, and if the coal be delivered at 40s. a ton the gas will be usable to the exclusion of coal by even the poorest houses at 4·8d.

a therm. This, incidentally, must be slot meter price, and it seems absurd to cause our largest potential customers (in the mass) to pay so dearly for the privilege of paying cash in advance for their gas. It must be remembered that this 100-therm equivalent figure is based on the gas fire or cooker being turned off when not required. In the depths of winter this chills the room too much, and a fire must burn all day in those rooms that are to be frequently used. Probably the true figure in practice is nearer 150 therms, and this means a delivered cost of 3·2d. per therm of gas if the all-gas house is to be possible.

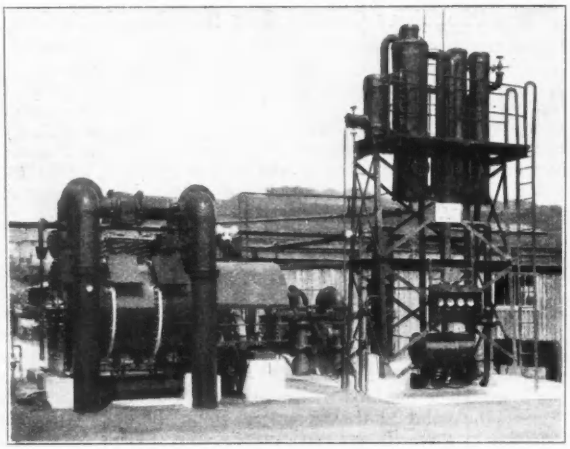
Where the price of house coal is 40s. to the consumer, the cost of gas coal at the works may be of the order of 1d. a therm. Mr. E. V. Evans in his Institution Paper gave the processing cost at 150d. per ton of coal, making a total cost of coal and processing of 450d., or 1·97d. per therm of total salable products *plus* capital charges. The cost of distribution may be as low as 0·5d., or it may be over 2d. per therm, a fair figure would be about 1d. or 1·5d. It is clear, therefore, that we have a total gas cost with present methods from coal to consumer of 3d. or 3·5d. per therm, and it looks on the face of it as though we might consider the all-gas house, even though management, profits, and other items have yet to be added on.

But alas! this method of computation leaves us with 135 therms of coke valued at 1·97d. per therm, or about 45s. a ton at works. If we put in the all-gas house, as our customers in the future are likely to demand, we shall not have a sale for this coke, except possibly for industrial uses, and certainly it will fetch nothing like 45s. at works. If we resort to total gasification, we must start with a raw material costing 45s., or about double that of the coal initially. Obviously this is not the way to cheap gas. We have to search for a method of treating coal, not necessarily based on present methods, and entirely free from present beliefs and biases, that will convert this 135 therms of coke into gas at a cost of less, and possibly considerably less, than 1·97d. per therm of gas made. Probably, if the all-gas house is to be possible, the total cost of gas must not exceed 1·5d. per therm into holder, which, it will be noted, is not much above the cost of coal. It is a very important problem in the light of modern tendencies, and with the best will in the world the writer cannot see any suggestion so far made leading to cheap gas.

Benzole Recovery on a Gas-Works

With Output Less than 100 Million Cu.Ft. per Annum

An account of working conditions at the Berkhamsted Gas-Works, by G. W. Ellis, M.Inst.Gas E., Managing Director, Engineer, and Secretary.



The benzole washing plant at the Berkhamsted Gas-Works consists of Messrs. W. C. Holmes & Co.'s rotary brush washer with effective washing surface of 2,500 sq.ft., driven by a slow speed steam engine. The average surface per 1,000 cu.ft. per day is therefore approximately 10 sq.ft. The washer was installed in 1925 in connexion with naphthalene extraction, and later incorporated in the benzole recovery installation.

The oil stripping plant is substantially of mild steel construction and comprises a 15 in. internal diameter still having an outside annular jacket for live steam, and packed with special ring filling, vapour-to-oil heat exchanger, all lagged with Newalls insulating material, separators for heavy distillate and benzole, benzole condenser, open rack type oil coolers, benzole storage tank; benzole loading pump, panel with control instruments, &c.

The oil is circulated through the stripping plant by means of a Douglas positive rotary displacement pump driven from the washer engine shaft.

Operation.

Benzolized oil is drawn from the end bay of the washer and pumped through the preheaters into the top of the still. Live steam, or exhaust steam, admitted at the base of the still, meets the hot oil flowing down the special ring filling. Benzole is distilled from the hot oil, and the benzole vapours and steam pass forward to the vapour-oil heat exchanger. The hot debenzolized oil from the still flows by gravity through the oil coolers and back to the washer. The quality of benzole is controlled by a thermostat in the vapour space of the vapour-oil heat exchanger which operates a Hopkinson control valve on the open steam line to the still; thus the temperature of the vapours leaving the vapour-oil heat exchanger is maintained constant, a slight change in temperature causing the Hopkinson valve to admit more or less steam to the still to hold the required temperature.

Condensate from the vapour-oil heat exchanger flows to the heavy fraction separator where the heavy fraction and condensed water are separated. The lighter vapours leaving the vapour-oil heat exchanger are condensed in the benzole condenser, the benzole and water being separated in the benzole separator which is situated immediately below the condenser. The separated benzole flows to the storage tank by gravity and a sight box is fitted in the line for visual examination of the finished product. A sight box is also fitted on the heavy fraction line.

Performance Figures.

The working conditions and performance of the benzole plant over a period of eight weeks, March and April, 1938, are set out below:

	March.	April.
Live steam per gallon of benzole, lb.	12·4	10·9
Oil circulated, gallons per hour	90	80
Benzole per ton of coal, gallons	2·91	3·1
Oil make up, gallons	26	47
Total benzole made, gallons	1,495	1,465
Quality:		
% distillate to 120° C. (retort)	81	83½
S.G. at 60° F.	0·870	0·868
Live steam per gallon of oil circulated, lb.	0·35	0·32
Gas make, cu.ft. (after benzole extraction)	7,369,000	6,817,000
Coal carbonized, tons	514	475½
Therms made (after benzole extraction)	36,845	34,085

Organic sulphur:		
Inlet gas	=	21·2 grains per 100 cu.ft.
Outlet gas	=	15·2 " " "
Reduction	=	6·0 " " "
	=	28·8%

Naphthalene:
Naphthalene in outlet gas, *nil.*

Control instrument readings:

Oil temperature inlet still	=	95° C.
" " outlet still	=	112° C.
" " leaving coolers	=	15° C.
Vapour temperature outlet vapour-oil heat exchanger	=	98·5° C.
Steam to still jacket	=	30 lb. per sq.in.
Steam to preheaters and open steam to still	=	5–6 lb. per sq.in. (exhaust steam)
Cooling water to benzole condenser and rack coolers	=	50 gallons per hour
Wash oil used		Benzole absorption oil (Shell Mex) Distillate less than 1% at 150° C.
Benzole content of gas		3·4 gallons per ton of coal

Economics.

The following balance-sheet is calculated upon a basis of 1 gallon of benzole, from the above figures for March and April, 1938.

Debit:

Capital cost £750 at 10% per annum	=	0·936d. per gallon
Repairs and maintenance £750 at 5% per annum	=	0·468d. " "
Gas rental 1·55 therms per gallon at 3·85d. per therm	=	5·967d. " "
Oil make up at 9d. per gallon	=	0·223d. " "
Water 25 gallons at 3d. per 1,000 gallons	=	0·075d. " "
Steam 11·7 lb. at 1s. 4d. per 1,000 lb.	=	0·187d. " "
Operating labour	=	0·194d. " "
Total cost of 1 gallon of benzole	=	8·050d. " "

NOTE.—Cost of gas into holder includes all expenses connected with manufacture, less receipts for residuals. It does not, however, include depreciation of gasholders.

Credit:

Received for 1 gallon 81's benzole	=	11·76d.
Profit per gallon of benzole	=	3·71d.

General.

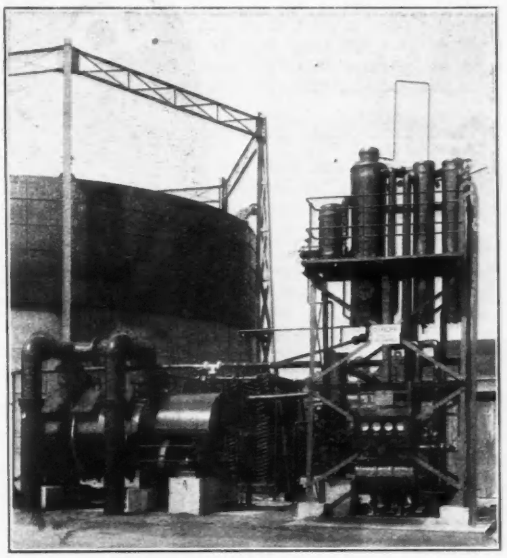
The plant, which was supplied and erected by Messrs. W. C. Holmes & Co., Ltd., of Huddersfield, was put to work in April, 1937, and, apart from some minor adjustments, has given complete satisfaction. No trouble whatsoever has been experienced from the point of view of sludge in the wash oil, and on no occasion has it been necessary to dismantle any part of the plant.

The oil make-up figures are an improvement on corresponding figures for gas oil. In fact, the cost for oil make-up is only 0·223d. per gallon of benzole produced.

With the ample oil cooling capacity provided, there has been no difficulty in maintaining the debenzolized oil temperature at 15° C., except during the hottest weather, when the temperature does not exceed 20° C. In fact, no water is required during the winter months, and only a minimum quantity during the summer period, the maximum not exceeding 25 gallons per hour. With regard to the steam figures, it is apparent that the use of exhaust steam in all parts of the plant, with the exception of the still jacket, has, coupled with the small amount of water used for cooling and condensing, led to a marked economy with corresponding increase in receipts obtained from the process.

It should be borne in mind that the steam used for working the rotary washer engine has not been included in the steam figure per gallon of benzole. As the washer would normally be working for naphthalene extraction, the cost of steam for same is included in cost of gas to holders.

No trouble has been experienced on the district due to naphthalene, the gas at outlet of holders being naphthalene free. The reduction of organic sulphur compounds in the gas, amounting to approximately 30%, has led to the extended use of portable gas appliances, as well as being beneficial to the working of all other types of apparatus in the Company's area.



In conclusion, attention should be drawn to the small amount of operative labour necessary with a plant of this kind, the figure being less than ¼d. per gallon of benzole produced. Steady conditions have been maintained throughout, and I am convinced that benzole extraction on works making under 100 million cu.ft. per annum is an economic proposition and will add substantially to the revenue of any undertaking adopting the process—providing, of course, that the cost of gas into holder is not too high.

Amalgamation and Grouping

United Kingdom: Further Acquisitions.

Close Brothers, Ltd., Secretaries of the United Kingdom Gas Corporation, Ltd., announce that the Corporation has recently acquired control of the Hemsworth, Grimethorpe, and District Gas Company and the Aspley Guise and Woburn Sands Gas Company.

The Hemsworth Company is the twenty-fourth Gas Undertaking in Yorkshire to come into the Corporation's control and is within the area of the gas grid for the construction of which the Corporation recently received statutory authority through its subsidiary, the West Yorkshire Gas Distribution Company. The Aspley Guise Company adjoins other Subsidiary Companies in the Corporation's South Midlands Group.

These purchases follow the acquisition of three Municipal Gas Undertakings in the Corporation's Lancashire and Cheshire group, the Gas Undertakings of the Dukinfield Corporation and of the Denton Urban District Council being combined with the Hyde Gas Company into the North Cheshire and District Gas Company and the Undertaking of the Radcliffe and Little Lever Joint Gas Board being amalgamated with the Farnworth and Kearsley Gas Company to form the Radcliffe, Farnworth, and District Gas Company.

As a result of these purchases the issued share and loan capital of the United Kingdom Gas Corporation is now £4,690,334, as follows:

	£
4½% First Cumulative Preference	1,051,280
4 % First Redeemable Cumulative Preference	762,241
4½% Second Non-Cumulative Preference	745,263
Ordinary	1,131,550
	3,690,334
3½% Redeemable Debenture Stock	1,000,000
	£4,690,334

Chepstow and Caldicot and District.

An extraordinary general meeting of the Caldicot and District Gas Light and Coke Company, Ltd., is to be held on Sept. 6 for the purpose of sanctioning the transfer of the Undertaking of the Company to the Chepstow Gas Company. On the same day Chepstow Gas Company will hold an extraordinary general meeting for the approval of the provisional agreement between the two companies.

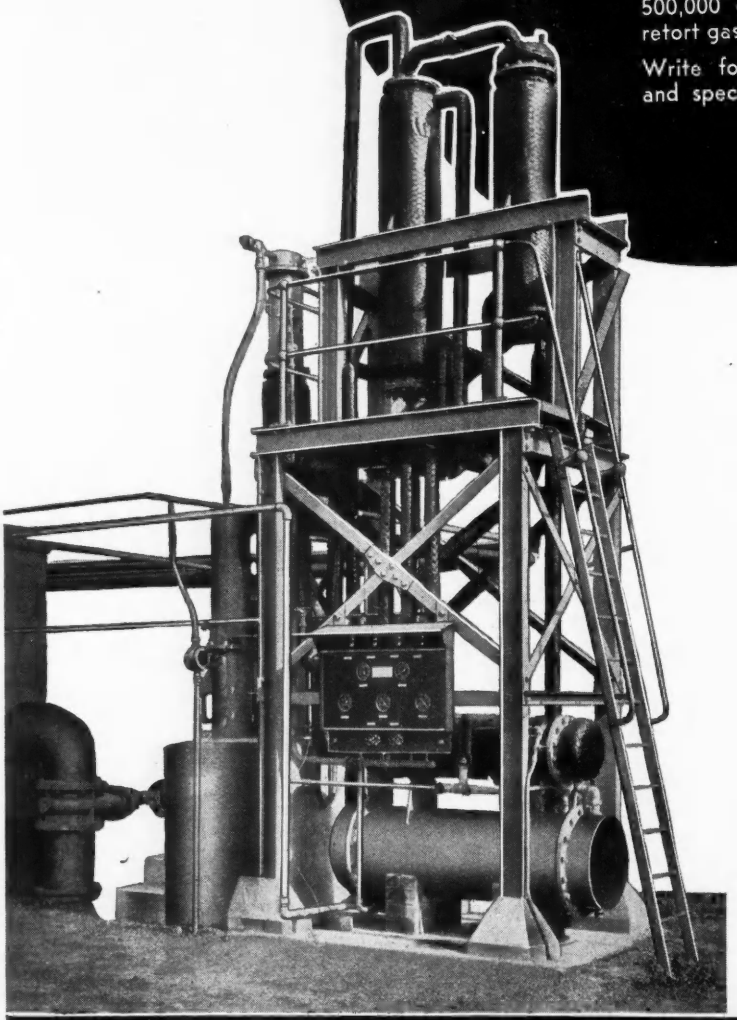
A main is being laid from Newport to supply both Undertakings with coke oven gas, which the Newport Company is now receiving from the Bedwas coke oven of the British Benzole and Coal Distillation Company. All three Gas Undertakings are controlled by the Severn Valley Gas Corporation, Ltd.

BENZOLE PLANT

We are specialists in the design and manufacture of Benzole Recovery Plants of all sizes, our largest installation to date having a capacity of 16 million cu.ft. per diem.

The plant illustrated is a typical example of one of our smaller installations. This is installed at Hawick Gas Works for the recovery of two gallons of benzole per ton of coal from 500,000 cu.ft. of vertical retort gas per diem.

Write for full particulars and specifications.



NEWTON, CHAMBERS & CO. LTD.

THORNCLIFFE IRONWORKS • • NR. SHEFFIELD

MODERN DEVELOPMENTS IN THE Purification of Coal Gas

[Contributed]

Although methods of carbonization have undergone considerable change in the past few years, it is remarkable that the removal of the major gaseous impurities, hydrogen sulphide, hydrocyanic acid, and ammonia, is carried out to-day almost exactly as it was thirty years or more ago. It is true that the types of plant in use and the methods of control employed have been greatly improved, but the principle of condensation followed by counter-current washing with ammoniacal liquor and oxide purification for hydrogen sulphide is unchanged. Even before the War many processes had been suggested, and in some cases tested on a large scale, in which the hydrogen sulphide, ammonia, and hydrocyanic acid were simultaneously removed, and it is of interest to mention briefly one or two of the better known of these.

In the first place it should be remembered that there is insufficient ammonia to remove the acidic impurities—viz., hydrogen sulphide and hydrocyanic acid. The average recovery of sulphur is about 10-12 lb. per ton of coal, which is equivalent to an equal weight of ammonia recovered as sulphate of ammonia. The ammonia actually recovered is, however, only half this figure. Hence, irrespective of whether the sulphate of ammonia is made indirectly via sulphuric acid and gas liquor or whether it is produced directly as in the Burkheiser and other processes there is always some 6 lb. of sulphur per ton for disposal. At the present time this is almost entirely disposed of in the form of spent oxide and the sulphur ultimately is transformed into sulphuric acid. Based on the ammonia now recovered some 30,000-40,000 tons per annum of sulphur are available in excess of the quantity required for by-product sulphate of ammonia production. The difficulty of the excess of acidic over alkaline impurities is overcome in the Claus process by revolatilizing the ammonia from the liquor into the gas stream, the majority of the hydrogen sulphide and some of the carbon dioxide being removed in the subsequent washing plant. By heating the resulting liquor, the hydrogen sulphide and carbon dioxide are driven off and the hydrogen sulphide is burnt with deficiency of air in the Claus kiln to yield sulphur. The ammonia is returned to the gas. Obviously such a process could not give complete removal of hydrogen sulphide and ammonia and the large losses of ammonia rendered the process uneconomical.

In the Burkheiser process the principle was carried further in that ammonium sulphate was produced directly without the intervention of sulphuric acid. Briefly, the hydrogen sulphide was combined with a very active oxide which, when completely fouled, was denuded of its sulphur by hot air, the sulphur passing directly to sulphur dioxide. This was absorbed in ammonia liquor forming ammonium sulphate, thiosulphate, &c. The two main difficulties encountered and which ultimately caused the abandonment of the process were the oxidation of this salt to sulphate of ammonia and the loss of activity of the oxide. In another process proposed by J. W. Cobb zinc sulphate was used to effect combustion of hydrogen sulphide and ammonia to sulphate of ammonia and zinc sulphide, the zinc sulphate being roasted to the oxide and hence re-converted by the sulphur dioxide produced into zinc sulphate. None of these processes and the many variations has, however, stood the test of time and practice. In more recent years there has been a steady flow of schemes for the combined recovery of sulphur and ammonia but very few have attained any scale. In the Koppers "polythionate" of C.A.S. process the hydrogen sulphide and ammonia are absorbed by a solution of ammonium polythionates, the polythionates thus formed being converted by sulphur dioxide into thiosulphates. The key of the process lies in the conversion of polythionates and thiosulphates, by heating under pressure into sulphate of ammonia and sulphuric acid. This is really a development of the earlier Feld process and although many Papers and patents have been published the process does not appear to have been adopted on any scale. There are various drawbacks to processes involving the use of pressure autoclaves, &c., and complicated chemical reactions.

Tendency to Achieve Self-Sufficiency.

During the past few years there has been a growing tendency in most countries to achieve self-sufficiency, particularly in such basic materials as nitrogen and sulphur, which are of vital importance in wartime. This has quite naturally led to a revival of interest in methods of recovery of sulphur from distillation gases. In Germany, whence the majority of these proposals originate, there is a particular incentive since a large proportion of the coke oven gas produced in the Ruhr area is at present utilized in the crude unpurified state, the sulphur being lost to the atmosphere as sulphur dioxide. It has recently been stated that the total sulphur content of the coke oven gas from the Ruhr district was 110,000 tons in 1937 and will increase to 135,000 tons in 1938. The sulphur actually recovered is, however, only 35,000 tons. The need for complete removal to the limits enforced in this country does not exist for much of the German coke oven gas, and consequently processes may be utilized which would be unsuitable here without final oxide purification.

The processes for the removal of hydrogen sulphide and the recovery of sulphur may be divided into three groups:

(1) Methods based on the oxidation of hydrogen sulphide to sulphur dioxide and sulphur.

(2) Methods based on the absorption of hydrogen sulphide in solvents.

(3) Methods based on the simultaneous removal of ammonia and hydrogen sulphide.

1. If crude coal gas together with sufficient oxygen is passed through active carbon the hydrogen sulphide is oxidized to sulphur. The sulphur may then be dissolved out of the carbon by a suitable solvent—ammonium sulphide solution being generally used—and the carbon re-activated for further use. The sulphur is recovered by boiling the polysulphide solution to volatilize the ammonia, the sulphur being filtered from the residual liquor. This process has been in use at the Leuna Works of the I.G. on a large scale for several years for the purification of coke oven gas and water gas.

There are various difficulties in the direct oxidation to sulphur and a somewhat impure product is obtained. Hence it is now the practice to pass a mixture of hydrogen sulphide and sulphur dioxide through active carbon producing sulphur which is melted out of the carbon at the reaction temperature. Thus to a coal gas containing 0·4% hydrogen sulphide, sulphur dioxide equivalent to 0·2% is added and the mixture passed through active carbon at 120°-170° C. To avoid the need for accurate proportioning of sulphur dioxide and hydrogen sulphide the carbon can be initially saturated with sulphur dioxide, the gases being switched to a fresh batch when all the sulphur dioxide is converted to sulphur. A very pure form of sulphur is obtained in this way. This process is utilized in several plants in Germany notably for the removal of sulphur from gas used for the Fischer hydrocarbon synthesis and hydrogenation processes. This method of sulphur removal does not appear to have been applied to the purification of town gas, although there would appear to be no serious objection except the question of cost.

It is, of course, possible to utilize the reaction between hydrogen sulphide and sulphur dioxide without the aid of active carbon. Thus the Sulphur-Chemie A.G. (B.P. 459,418)

propose to pass the mixed gases into a solution containing sodium thiosulphate, which solution has previously been "activated" by treatment with a mixture of sulphur dioxide and hydrogen sulphide, the thiosulphate content being thereby maintained below a certain value corresponding to a given P*h* value of the solution. This process is complicated by the necessity of maintaining the solution at a certain composition and by having to provide the necessary sulphur dioxide. The Otto Company (G.P. 632,670) have a variation of the above, in which the sulphur dioxide is first dissolved in an organic base into which the hydrogen sulphide is passed, sulphur being precipitated and removed by filtration. As far as is known neither of these two processes is working on a large scale.

2. Although it might appear a simple matter to remove hydrogen sulphide by dissolution in a solvent, the complete removal of hydrogen sulphide to the limits required in town gas by such methods has not yet been achieved in this country. The Koppers Company of America have developed the use of various solvents from which the sulphur can be liberated by blowing air through the solvent. In the earliest of these—the Seabord process—the hydrogen sulphide and hydrocyanic acid are absorbed in soda ash solution, which solution is subsequently revivified by passing through it a current of air. The hydrogen sulphide is removed in the air, which is disposed of to the atmosphere or burnt under boilers, &c. In the Thylox process the gas is washed with a solution of sodium carbonate and arsenic trioxide. The sodium arsenate formed by the interaction of the above two compounds is a very active absorbent for hydrogen sulphide, forming sodium thioarsenate, which is in turn oxidized to thioarsenite. This latter compound is the normal Thylox reagent which absorbs hydrogen sulphide and liberates free sulphur on subsequent oxidation. In place of the sodium the ammonium salt can be used equally efficiently and is more economical for coal gas purification, where a supply of ammonia is available. Whereas with the original Thylox process only about 98% of the hydrogen sulphide was removed it is claimed that the present two-stage process effects removal to under 0·2 grain per 100 cu.ft. (4 parts per million). The bulk of the hydrogen sulphide is removed in the first stage, and the final trace by a second washing with a small quantity of fresh solution, this subsequently being added to the main circulating solution. A large plant, to purify 45 million cu.ft. of blue water gas per day has been erected at the Dupont works at Belle, W.Pa., and complete removal of hydrogen sulphide to give a clean lead paper is claimed. The cost of purification by the Thylox process has been given as about 0·025d. per therm, which is somewhat below the average cost of oxide purification in this country. The value of the sulphur recovered is equivalent to roughly half the operating cost, and hence the net cost will depend largely on the price obtainable from this product. In the above cost, this has been credited at about £3 15s. per ton, which is comparable with its value in this country. It would appear, therefore, that the Thylox process in its latest form compares very favourably with oxide purification for large units, and that complete hydrogen sulphide removal may be effected without the use of oxide catch boxes. There would be no justification for the adoption of this method of hydrogen sulphide removal unless appreciable economy in operating costs was assured, and data from a plant operating in this country are desirable to give such information.

The most recent method of the Koppers Company is the absorption of the hydrogen sulphide in sodium phenolate solution. This process is more particularly suitable for gas containing 4-5% of hydrogen sulphide and gives an extraction of 95-99%. The hydrogen sulphide is passed through a bubble tower down which the phenolate solution is flowing, this being pumped to a second tower in which the hydrogen sulphide is liberated by blowing steam through the solution. Some 5-10 gallons of phenolate are used per 1,000 cu.ft. of gas. As carbon dioxide is also absorbed this impurity must also be removed before the gas enters the absorption tower. This is effected by passing the gas first through milk of lime; presumably some of the hydrogen sulphide is absorbed at this stage.

Details have been given of a plant to purify refinery gases for the Standard Oil Company of California. The crude gas contains 2,700-4,800 grains of hydrogen sulphide per 100 cu.ft. and the efficiency of removal varies from 95-98%.

Use of Weak Organic Bases.

The use of weak organic bases as absorbents from which the hydrogen sulphide is revolatilized on heating has obvious attractions. This method was first developed by the Girdler Company, of America, who used tri- and di-ethanolamines. Both carbon dioxide and hydrogen sulphide are absorbed and are subsequently released by passing steam through the solution. Several plants have been erected in the United States for the purification of refinery gases, &c. These solvents are relatively expensive and hydrogen sulphide removal beyond about 2-4 grains per 100 cu.ft. is not claimed. More recently, inorganic salts—*i.e.*, sodium meta arsenate—have been added to the solution of the absorbent, and improved results are claimed. These compounds are less volatile than the amino acids and hence there is a smaller loss of solvent during regeneration. The I.G. Farbenindustrie have now filed a number of patents covering the use of solutions of primary, secondary, and tertiary amino acids, these acids being treated to prepare salts of the alkaline earth metals. As in the Girdler process washing the liquid is regenerated by heating. To ensure complete removal of the hydrogen sulphide from the wash liquid it is proposed to mix this with a similar wash liquid which has been used for carbon dioxide removal and then to heat the mixed liquids. No details have yet been published regarding the use of these solvents on a works scale.

A suitable process for the conversion of hydrogen sulphide to sulphur or sulphur compounds is, of course, essential in conjunction with the absorption methods, in which hydrogen sulphide is liberated from the solvent. As previously mentioned, the hydrogen sulphide can be passed through a Claus kiln to yield sulphur, but this method has not found general favour. Recently the Metallgesellschaft of Frankfurt have devised a process of catalytic oxidation of hydrogen sulphide to sulphur trioxide and the absorption of this gas in the water resulting from the same reaction.

Ninety per cent. sulphuric acid can be produced by this process, which is carried out in a small and compact plant requiring little technical control. A small unit of this type is in operation at the Beckton By-product Works of the Gas Light and Coke Company, using the hydrogen sulphide gas from the sulphate of ammonia saturators.

3. There are two processes which have attracted considerable interest in Germany and in this country, in both of which ammonia and sulphur are recovered directly as sulphate of ammonia.

The first of these is the process of the Gesellschaft für Kohlentechnik, which is being tried out on a scale of 3½ million cu.ft. per day at the Kokerei Kaiserstuhl.* The present process is an improvement of an earlier one of the same Company which has been in operation at the Mt. Cenis coke oven plant for several years. As the hydrogen sulphide is absorbed in an iron oxide suspension, the hydrocyanic acid must be first removed by washing with a solution of ammonium polysulphide. The hydrogen sulphide is then absorbed by the iron oxide and the resulting sulphide oxidized by air liberating free sulphur. Sulphur dioxide produced by burning some of the recovered sulphur is added to the crude gas and combines with the ammonia to form ammonium sulphite which passes into solution on washing.

Similar Costs to Oxide Purification.

By treating this solution with sulphur at an elevated temperature ammonium thiosulphate is formed. This solution is then treated with 60% sulphuric acid at 100° C. and yields sulphate of ammonia and free sulphur. The latter is filtered off and the sulphate of ammonia crystallized out in an evaporator. The process appears long and somewhat involved, but the costs are claimed to be similar to those obtained in oxide purification. The capital cost involved is given as 0·5 mark per 1,000 m³, which is compared with 0·6 mark per 1,000 m³ for oxide boxes. The two figures are not really

* Weittenhiller. *Glückauf*, Feb. 12, 1938.

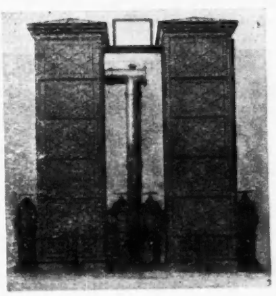
comparable as the former represents the capital cost for recovery of both ammonia and hydrogen sulphide as sulphate of ammonia. The cost of combined extraction of ammonia and hydrogen sulphide is given as 37 marks per 100 kilos. of nitrogen, which is equivalent to about 75 marks per ton of sulphate of ammonia recovered. This cost, of course, includes all the costs normally incurred in ammonia scrubbers and washing plant, oxide purifiers, and sulphate of ammonia plant. If the cost of manufacture of sulphate of ammonia be taken as £5 10s. per ton, and of ammonia and hydrogen sulphide removal as equivalent to £2 10s. per ton of sulphate of ammonia recovered, a total of £8 per ton is obtained. At present exchange rates the German costs are roughly equal to £6 per ton, but conditions are so different in the respective countries that a direct comparison as above is hardly justified.

The second process is sponsored by the I.G., who are investigating its possibilities on a trial plant dealing with about a million cu.ft. of gas per day. In the so-called "Katasulf" process the crude gas is mixed with 8% of air and passed over a catalyst at a temperature of 350-450° C.* The hydrogen sulphide is oxidized to sulphur dioxide which is absorbed in a solution of ammonium sulphite and bisulphite. A portion of this solution is removed from time to time and treated with sulphuric acid under a slight pressure and at a temperature of over 100° C. The sulphites, &c., are decomposed, some free sulphur being formed together with sulphate of ammonia. The latter is recovered by evaporation and crystallization, after the sulphur has been removed by filtration. Although the temperature is high the reaction is exothermic and by the use of ample heat interchange the fuel consumption can be kept at a reasonable figure. No details are divulged regarding the catalyst employed, but it has been stated that the hydrocyanic acid in the gas is oxidized to a mixture of carbon dioxide and ammonia and that some of the unsaturated hydrocarbons are selectively oxidized, which reduces the refining losses in any subsequent benzole extraction process. For this reason the hydrogen sulphide removal is preferably carried out prior to the benzole extraction plant. There are two objections to this process if applied to town gas manufacture. The first is the large quantity of diluent nitrogen which is added to the gas. This difficulty may be overcome by the use of oxygen assuming that a cheap supply is available. Figures as low as 1s. per 1,000 cu.ft. of oxygen have been mentioned and it would be economic to use oxygen so long as its cost was below that of the coal gas at the inlet of the holder. The other difficulty is the loss of heating value due to the oxidation of hydrocarbons. To what extent this takes place is not stated, but it might prove an expensive factor, while there may be some combination of sulphur with unsaturated hydrocarbons giving additional organic sulphur compounds. In discussing the oxidation of hydrogen sulphide to sulphur it is interesting to note that Griffith* has recently found that using nickel sulphide catalyst, organic sulphur compounds can be oxidized to sulphur dioxide by the small quantity of oxygen normally present in coal gas and at the low temperature of 120° C. If the same reaction will take place with hydrogen sulphide this should constitute a considerably more economical method in view of the lower temperature employed.

A simple method of securing the combined removal of hydrogen sulphide and ammonia has been patented by H. Kemmer and M. Raschig (B.P. 466,067). Ammonia in excess of that required to combine with the hydrogen sulphide is added to the gas, which is then washed with water at a temperature of −5° to + 5° C. This is simply a modification of the old Claus process, but the cooling of the wash liquor not only increases the solubility but reduces the potential ammonia losses during operation.

* *Glückauf*, 1937, 73, p. 901.

* Inst. of Gas Engineers, Comm. No. 175, 1937.



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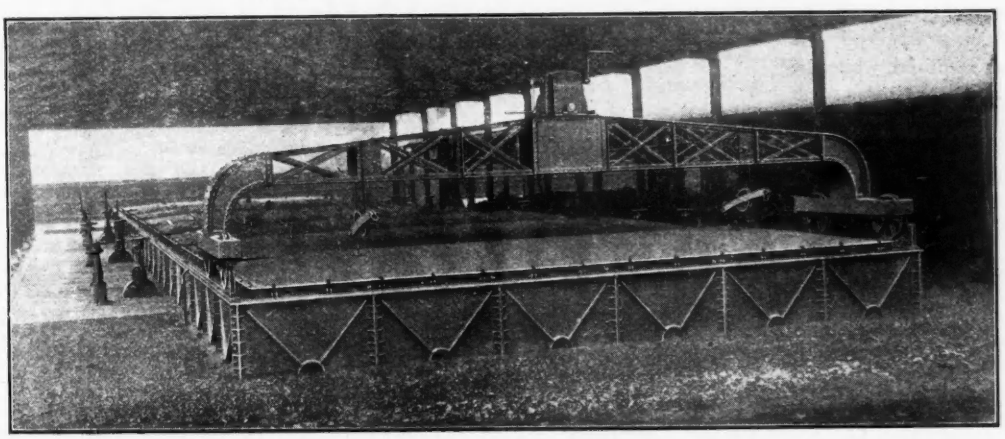
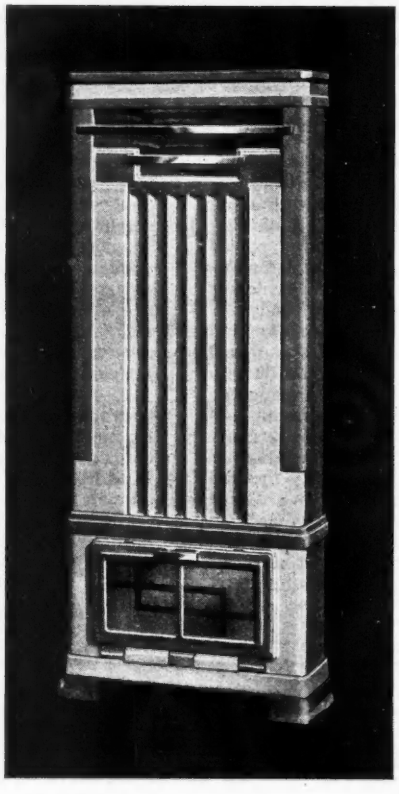


469

The Ideal Gas Heater for



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The VELOMAIN Heater is the best thing in Space Heating yet designed. In the first place, it needs no flue, the gas consumption being inside the limits for flueless heaters. Secondly, it is a most satisfactory heater, as it warms up quickly and circulates the air of a room 12×10×10 ft. over 2½ times each hour. As is fitting, its design is modern, and it is made in a variety of colour finishes, blending harmoniously with any scheme of decoration. Furthermore, thought has been given to upkeep. The design is simple and accessible for the little cleaning required, while the body is made from sheet steel, for long service, with cast-iron partswhere rigidity and strength are required.

TWO GREAT IMPROVEMENTS

Two very important developments have been achieved in the VELOMAIN Space Heater. The design ensures that the top and back do not become unpleasantly hot, while the heat is projected into the room at such an angle as to prevent discoloration of the walls or ceiling immediately behind or above the heater, thus obviating one of the greatest drawbacks found in the ordinary radiator of the past.

NOTE THESE UNIQUE PRINCIPLES

1. The large volume of pure air mixed with the heat stream issues horizontally from the Heater and so quickly warms the apartment.
2. The front body of the Heater is evenly warmed throughout its length.
3. The top and exterior back are kept cool by the constant stream of fresh air passing up the double back. Wall decorations are thus saved from damage by discoloration or deposit.
4. The amount of pure air drawn through the Heater ensures perfect combustion; prevents overheating and abolishes the necessity for any thermostatic device.

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Gas Undertakings' Results

Accrington.

In the annual report of the Accrington and District Gas Board, Mr. A. J. Harrison, Engineer and Manager, states that schemes for the improvement of Accrington's gas lighting could have been undertaken by the Board at a trifle of the cost of that incurred by converting gas to electricity. The changeover would cause an annual revenue loss of £1,000 to the Board, who would have to subscribe to the future lighting of the Borough by increased contributions to the lighting rate. The net deficit on the year's working was £873 against a surplus of £1,147 for the previous year. Expenditure was £58,729, and income £89,861, the gross profit being equal to 14·19% of the net indebtedness. Expenditure showed an increase of £2,248, the advances including: Manufacturing costs, £763; distribution costs, £1,218; rents and rates, £201; and management, £65. Income decreased by £135 and gas sales by £535. Revenue from gas totalled £88,376, of which £68,715 was collected from prepayment meters. The average rate per 1,000 cu.ft. sold was 2s. 11·479d. against 3s. 0·686d., or a reduction of £3,006. The gas sent out was 650,870,000 cu.ft. (increase 28,308,000 cu.ft.) while the gas accounted-for totalled 597 831,000 cu.ft., a record output and an increase of 23,164,000 cu.ft. over last year. The proportion of gas sold was: Prepayment consumers 46·88%, industrial consumers 27·79, public lighting 3·57, other consumers 21·06.

Bridport.

Dividends at the rate of 5% on the "A" preference, 6½% on the "B" cumulative preference, and 8% on the ordinary shares, less tax, were recommended by the Directors at the annual meeting of Bridport Gas Company. Presenting the Directors' annual report, the Chairman, Mr. W. G. Ralls, said he was pleased to say that the increase in the sale of gas reported last year had been maintained, and during the last two years this exceeded 1¼ million cu.ft. Mains had been extended at several points to supply new buildings, and the public were taking more gas for cookers, water heaters, and latterly for the economic working of refrigerators. During the year they had lost the services of their Manager, Mr. W. H. Reed, who had been a faithful servant of the Company for 34 years. His place had been taken by Mr. J. L. Mayes.

Carnforth.

The annual report of the Carnforth Gas Company showed that £1,191 was available for distribution, and it was proposed that a dividend of 9%, free of income-tax, be paid. This will absorb £900, leaving a balance of £291 to carry forward, subject to payment of Directors' fees. Mr. J. W. Hartley has retired from the Board and Mr. B. Pickard has been appointed to fill the vacancy. Mr. Benjamin Baker, Secretary, has also retired and Mr. E. H. Morris has been appointed to fill the vacancy.

Chesterfield.

Striking results are recorded by the Chesterfield Corporation Gas Department for the twelve months ended March 31. The increase in gas sales, mostly on the industrial side, is over 18½%, bringing the total output up to 729,408,000 cu.ft. The year's increase in the industrial load is nearly 60%, and there appears to be every likelihood of a further substantial addition during the current period. Negotiations for the supply of a largely increased quantity of gas to the Corporation's largest consumer have been concluded, with the result that agreements have been entered into with the Hardwick Bye-Product Company, Ltd., and the Grassmoor Company, Ltd. Purifiers have been erected by the Corporation at the Hardwick Collieries, and a 12-in. steel main laid for a distance of 6 miles for conveying the gas to the consumer's premises and to the central gas-works—the additional supplies of gas commencing at the close of the year. Already a large proportion of the output of the Corporation is coke-oven gas, the amount received during the twelve months under review having been 441,204,000 cu.ft. The total number of consumers continues to increase, the gain being entirely on the prepayment meter side. Another gratifying feature is the substantial increase in the number of appliances fixed. There is a healthy growth, too, in the number of public lamps. The net profit for the year is about £600 up, at £4,043. Central heating consumers took 203,460 therms. There are alternative attractive scales of charges at Chesterfield, while special agreements are made with very large industrial consumers.

Edinburgh.

The accounts of the City and Royal Burgh of Edinburgh Gas Department are for the twelve months to May 28, and they show a balance carried to net revenue account of £134,752, and contributions to reserve funds totalling £12,984. A year ago these contributions amounted to £29,248; but on the present occasion, while the gross revenue is £40,000 up at £796,376, the total for manufacturing costs, maintenance, management, &c., is up £52,000 at £649,615. The gas sold is up to 3,948,047,831 cu.ft., which compares with 3,951,435,841 cu.ft. for the previous year. While ordinary domestic consumers took somewhat less, more gas was used through prepayment meters, and nearly 40,000 000 cu.ft. more was taken by ordinary consumers other than domestic. The consumption in public lamps is about 30,000,000 cu.ft. up at 188,592,467 cu.ft., while there is a substantial drop in the gas unaccounted for, bringing it to 3·71%—the lowest figure shown in the analysis of accounts for the past ten years. The total number of consumers at May 28 was 135,586, which compares with 132,175 a year ago; while the number of public lamps was 25,907, as against 22,842.

Morpeth.

In their report to the shareholders for the year ended June 30 the Directors of the Morpeth Gas Light Company (1902), Ltd., state that the gross profit for the year amounts to £3,579, and that with the amount brought forward there is a total of £5,442 available for distribution. After the payment of a dividend of 6% for the year on the ordinary shares, there will remain to be carried forward a balance of £1,821. The output of gas has been increased by 2,000,000 cu.ft., and the Directors say that their policy in providing an up-to-date showroom has been fully justified. The demonstration hall has met a long-felt want, cookery lectures held during the year having been very largely attended.

Pitlochry.

A dividend of 6%, less tax, was declared at the annual meeting of Pitlochry Gaslight Company, presided over by Mr. John Marshall.

Wellingborough.

In their report for the year ended June 30 the Directors of the Wellingborough Gas Light Company, Ltd., express their regret that the increased cost of coal made it necessary to raise the price of gas by 2d. per 1 000 cu.ft., or 0·43d. per therm, from the beginning of April. The dividends are at the rates of 7½% on the original and 6% on the additional shares. This leaves a balance of £4,484 to be carried forward. A new showroom at Irthlingborough was opened in January, and extensive alterations to the Wellingborough premises have just been completed. At an extraordinary meeting following the ordinary general meeting the shareholders were asked to approve of the Company's application for a Special Order providing for the amalgamation of the undertaking of the Wollaston Gas, Coal, and Coke Company, Ltd., with the undertaking of the Wellingborough Company.

Trade Notes

C.O.L. Plant for Amiens.

Gas Chambers and Coke Ovens, Ltd., Artillery House, Westminster, London, S.W. 1, advise us that the town of Amiens, France, has just placed an order for a C.O.L. continuous vertical retort plant to consist of eight 54 in. retorts with ancillary equipment.

"P.A.L." Unbreakable Gas Globes.

The "P.A.L." (Protect-a-Lite) unbreakable gas globes, which have been on the market for nearly twenty-five years, are still deservedly popular. In addition to the protection which they provide for mantles, "P.A.L." globes are also much appreciated for their value as a fire precaution. For this reason they are recommended by fire insurance companies and assessors. These globes are obtainable through the usual wholesalers or from the patentees, Messrs. Pifco, Ltd.

Harland "Monoglide" and "Spiroglide" Pumps.

We have received attractive literature from the Harland Engineering Company, Ltd., Clifton House, 83-113, Euston Road, London, N.W. 1, dealing with "Monoglide" and "Spiroglide" pumps. The former type is claimed to be a thoroughly reliable and efficient single-stage pump of such simple and ingenious construction that its putting into service and maintenance are substantially unskilled tasks. Its first cost is low. The latter are stated to be in use in many of the largest water supply and industrial undertakings at home and abroad.

"Dixit" Belting.

"Dixit" is a textile belt made from the highest grade cotton duck and impregnated with a solution of gums which gives a remarkable cohesion of the plies and enhances the frictional grip and flexibility of the belt. This solution increases the belt's resistance to heat and the deleterious effect of acid fumes and humid atmosphere. A recently issued catalogue contains many unsolicited testimonials paying tribute to the excellent service rendered by "Dixit" belting in a variety of situations and under widely differing conditions. "Dixit" is one of the products of Messrs. R. & J. Dick, Ltd.

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**GAS FIRE TAPS, HOB TAPS,
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May We Quote You?

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QUALITY

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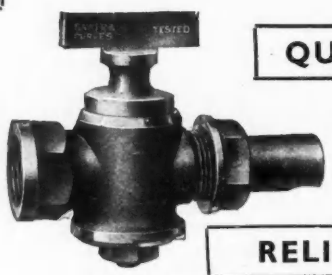

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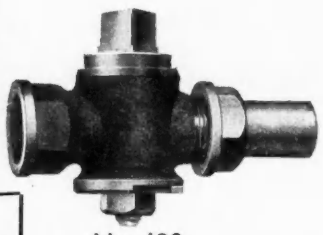

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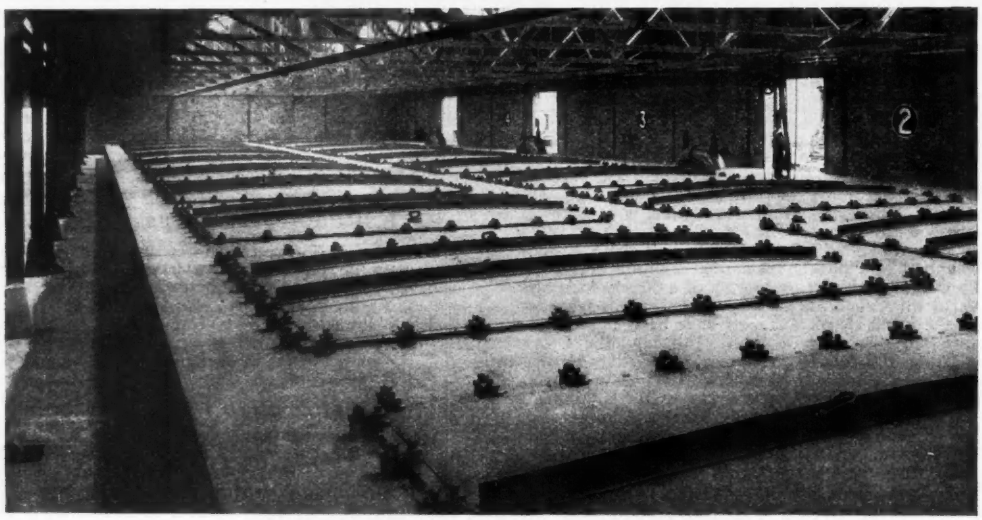

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FIVE PURIFIERS 45 FT. x 35 FT. x 6 FT. WITH MILBOURNE OUTSIDE VALVES.

COMPLETE PURIFIER INSTALLATIONS

WITH C.I. OR STEEL BOXES

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Nr. WELLINGTON—SHROPSHIRE

'Phone: Lilleshall-Shropshire Nos. 34 & 35 (2 lines)
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London Office - - - 70, VICTORIA STREET, WESTMINSTER, S.W.1.

'Phone: Victoria No. 1941
'Grams: "Fortress," Sowest, London

Markets and Manufactures

Current Sales of Gas Products

The London Market

Aug. 29.

To-day's values of Tar Products in the London market are as follows:

Pitch, nominal at about 33s. per ton f.o.b.
Creosote, about 4¼d.
Refined tar, 3¾d.
Pure toluole, 2s. 1d. to 2s. 2d.
Pure benzole, about 1s. 9d.
95/160 solvent naphtha, 1s. 7d.
90/160 pyridine, about 10s.
All per gallon naked at makers' works.

The Provinces

Aug. 29.

Crude Gas-Works Tar, 15s. to 20s.

To avoid misunderstanding, it is necessary to state that the above price is not claimed to represent a market value. It is a price worked out from week to week upon a system which has been used for many years as a basis for the fixing of certain contracts for crude tar of varying qualities in different areas.

The average prices of gas-works products during the week were: Pitch—East Coast, 31s. to 32s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 31s. to 32s.* Toluole, naked, North, 1s. 7½d. to 1s. 9d. Coal tar, crude naphtha, in bulk, North, 7½d. to 8¼d. Solvent naphtha, naked, North, 1s. 4½d. to 1s. 5d. Heavy naphtha, North, 1s. 3d. to 1s. 3½d. Creosote, *ex* works, in bulk. North, liquid and salty, 4¾d. to 4⅞d.; low gravity, 4½d. to 4¾d. Carbolic acid, 60's, 1s. 9d. to 2s. Naphthalene, £13 10s. to £16. Salts, 70s. to 75s., bags included. Anthracene, "A" quality, 4½d. to 4¾d. per minimum 40% purely nominal; "B" quality unsalable. Heavy oil: Unfiltered heavy tar oil, min. gr. 1,080, 4¾d. to 4⅞d.; filtered heavy tar oil, min. gr. 1,080, 5¼d. to 5⅜d.; heavy tar oil, gr. less than 1 080, 4¼d. to 4¾d.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Scotland

GLASGOW, *Aug.* 27.

The market is still suffering from lack of new business but, on the whole, makers' prices are fairly well maintained.

Crude gas-works tar.—Actual value is about 37s. to 38s. per ton *ex* works in bulk.

Pitch is only in small request with value about 25s. per ton f.o.b. for export and 23s. per ton *ex* works in bulk for home trade.

Refined tar is well maintained with prices unchanged at 3¾d. to 4d. per gallon in the home market and 3d. to 3¼d. per gallon in buyers' packages at makers' works for export.

Creosote oil.—A small but steady business is taking place at the following prices: Specification oil, 4¾d. to 5d. per gallon; low gravity, 5¼d. to 5⅜d. per gallon; neutral oil, 5d. to 5¼d. per gallon; all *ex* works in bulk.

Cresylic acid.—Demand is exceptionally slow and prices are nominal as under: Pale, 97/99%, 1s. 6d. to 1s. 8d. per gallon; dark, 97/99%, 1s. 4d. to 1s. 6d. per gallon; and pale, 99/100%, 1s. 9d. to 2s. per gallon; all according to quality, *ex* works in buyers' packages.

Crude naphtha continues to command 5½d. to 6d. per gallon *ex* works in bulk, according to quality.

Solvent naphtha.—90/160 grade is easy at 1s. 4d. to 1s. 4½d. per gallon and 90/190 heavy naphtha is 1s. 1d. to 1s. 1½d. per gallon.

Motor benzole is called 1s. 4d. per gallon.

Pyridine.—90/160 grade is 8s. 6d. to 9s. per gallon and 90/140 grade is 9s. 6d. to 10s. per gallon.

Benzole Prices

These are considered to be the market prices for benzole at the present time:

	s. d.		s. d.	
Crude benzole..	0 9¾	to	0 10	per gall. at works
Motor „ ..	1 3	„	1 3¾	„ „ „
90% „ ..	1 4	„	1 4½	„ „ „
Pure „ ..	1 8	„	1 8¾	„ „ „

Contracts Advertised To-Day

Coal.

Shipley Gas Department. [p. 542.]

Dividend Announcement

Hastings.—The Hastings and St. Leonards Gas Company are paying interim dividends (less income-tax) at the following rates per cent. per annum: £7 on the 5% converted stock; £5 10s. on the 3½% converted stock; £6 8s. on the 5% additional stock.

Applications for Patents

BRITISH OXYGEN COMPANY, LTD., AND SCHUFTAN, P. M.—Separation of constituents of coal-distillation gases. No. 19532.

FOSTER, A. S., AND GILL, G. M.—Pipe joints. No. 19834.

GAS LIGHT AND COKE COMPANY, MINCHIN, L. T., AND ROBERTSON, E. C.—Gas burners. No. 19413.

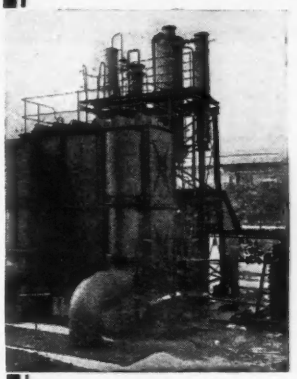
NEALE, J. E., AND GUEST, A.—Water-actuated gas valves.

Complete Specifications Accepted.

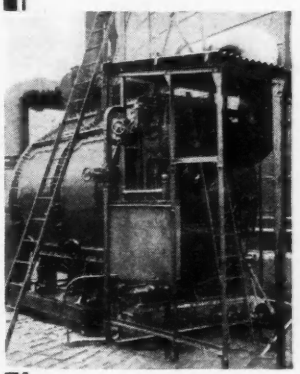
Newark Gas Department

The results of the Newark Gas Department for the year ended March 31, 1938, show an increased output of 1·7% to 188 million cu.ft. Income amounted to £49,949 and expenses to £35,345, leaving a gross profit of £14,604. After payment of interest, £3,605, sinking fund, £6,715, reserve for working balance, £196, and income-tax, £2,068, there remains a net profit of £2,020 (against £3,082).

25 Years' Hard!



"Permac" Joints in a Gas Works.



"Permac" Joints in a Gas Works.

Ever since 1913 "PERMAC," the original Metal-to-Metal Jointing, has been holding up difficult joints like these in important Gas Works and on Coke Oven Plants all over the world. Equally suitable for any joint—steam, water, gas, oil — screw pipe or flange.

Send for particulars

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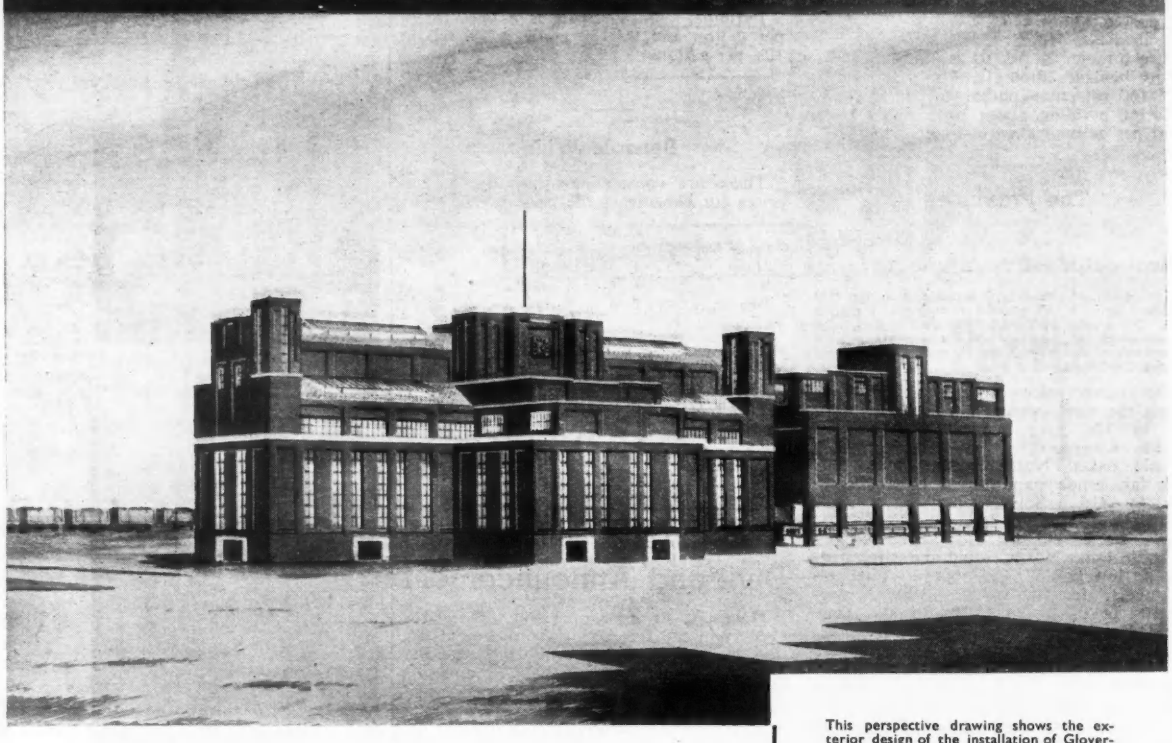
NEW

Glover-West PLANT FOR BLACKPOOL



This perspective drawing shows the exterior design of the installation of Glover-West continuous vertical retorts ordered by the BLACKPOOL Gas Department for the new Corporation Gas Works to be established at Marton, as it will appear when completed. Interesting and important new features will make this 72-retort plant, with its extensive coal and coke-handling and waste-heat recovery equipment, an outstanding example of modern advances in carbonizing practice.

A carbonizing plant which will be one of the most complete and economical in operation so far erected in this country.

Dignity allied with utility in architectural treatment will be a striking external feature of Blackpool's new Glover-West installation. It will also embody the many advantages and amenities upon which the world-wide prestige of the Glover-West system has been built during 30 years of constant research and development for the advancement of gas production methods.

WEST'S GAS IMPROVEMENT COMPANY, LTD.

MANCHESTER: ALBION IRONWORKS, MILES PLATTING 'Phone: COLLYHURST 2961 : 'Grams: "STOKER, MANCHESTER"

LONDON: COLUMBIA HOUSE, ALDWYCH, W.C.2 'Phone: HOLBORN 4108 : 'Grams: "WESGASCO, ESTRAND, LONDON"

GAS STOCKS AND SHARES

The new Account opened last week in a slightly more cheerful atmosphere and a firmer tendency was apparent in most sections. Investors, however, are still holding aloof, and any hopes of some revival in business were quickly dispelled. There is still far too much uncertainty in the realm of international politics for the general investing public to commence operations, and that looked-for Autumn recovery still appears a long way off. Bargain hunting was in evidence, especially in the home rail market, and this assisted in stemming any undue weakness. Gilt-edged stocks maintained their values, and in the industrial section both the volume of business and price movements were very limited. Rubber shares brightened on the rise in the price of the commodity to over 8d. per lb., and a little more activity was noticeable in some gold mining shares.

The volume of business in Gas stocks and shares showed few signs of broadening, and, with the exception of a further batch of *ex div.* markings, there were few price changes. Further reactions took place in Gas Light units and Imperial Continental, the former dropping another 3d. to 23s. 6d. and the latter losing 4 more points to 116½. In the Provincial Lists it will be seen that two small increases occurred at Bristol, while in the Supplementary List a narrowing of the margins brought about reductions in the nominal values of Eastbourne "A" and "B" stocks.

In the lists of stocks and shares on offer this week appears a parcel of 10,000 Severn Valley Gas Corporation £1 4½% cumulative preference shares at 21s. 3d. free, yielding £4 4s. 9d.%, and a similar quantity of South Eastern Gas Corporation £1 4% cumulative preference shares at 19s. 3d. giving a return of £4 3s.%.

The Directors of the Guildford Gas Light and Coke Company, an undertaking which also supplies electricity in parts of its area, are offering for sale by tender £36,866 4% redeemable preference stock 1963-68 at par. After allowing for debenture interest the net gas revenue of the Company for the year to Dec. 31 last was £12,329 and the dividends on the preference stocks, including the present issue, require £3,203, so that the latter are covered nearly four times. The dividends on the ordinary stock have increased from 7½ to 8½% per annum during the last ten years and after payment of last year's dividend a balance of £16,003 was carried forward, in addition to which the Company has accumulated funds amounting to £31,818. Tenders should reach the Company not later than 11 a.m. on Sept. 19.

Official Quotations on the London Stock Exchange

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Aug. 26.	Rise or Fall on Week.
1,767,439	Mar. 7	8	8	Alliance & Dublin Ord. ...	145—155	...
374,000	June 20	4	4	Do. 4 p.c. Deb. ...	93—108	...
734,733	May 9	5	5	Asscd. Gas & Water U'd'ts Ord.	17/6—19/6	...
500,000	,,	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	19/—21/–	...
444,389	,,	§–/4	4	Do. 4 p.c. Red. Cum. Pref.	19/—20/–	...
296,523	,,	4	4	Do. 4 p.c. Irred. Cum. Pref.	16/—18/–	...
500,000	Mar. 7	3½	3½	Do. 3½ p.c. Red. Deb. ...	94—99	...
558,890	Aug. 22	7	7	Barnet Ord. 7 p.c.	157—162*	—1
300,000	Apl. 4	1/4½	1/9½	Bombay, Ltd.	24/6—26/6	...
179,915	Aug. 22	9½	9½	Bournemouth sliding scale ...	195—205*	...
590,407	,,	7	7	Do. 7 p.c. max. ...	157—162*	—1
493,960	,,	6	6	Do. 6 p.c. Pref. ...	133—139*	—½
50,000	June 20	3	3	Do. 3 p.c. Deb. ...	78—83	...
262,025	,,	4	4	Do. 4 p.c. Deb. ...	98—103	...
335,000	,,	5	5	Do. 5 p.c. Deb. ...	115—120	...
357,900	Aug. 8	7½	7½	Brighton, &c., 6 p.c. Con. ...	142—147	...
649,955	,,	6½	6½	Do. 5 p.c. Con. ...	126—131	...
205,500	,,	6	6	Do. 6 p.c. 'B' Pref.	125—130	...
855 000	Mar. 7	7	8	British Ord.	138—143	...
100,000	June 3	7	7	Do. 7 p.c. Pref.	140—145	...
350,000	,,	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	110—115	...
120,000	,,	4	4	Do. 4 p.c. Red. Deb. ...	94—99	...
450,000	,,	5	5	Do. 5 p.c. Red. Deb. ...	102—107	...
450,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	94—99	...
100,000	22 May'33	6	4	Cape Town, Ltd.	1—2	...
100,000	6 Nov.'33	4½	4½	Do. 4½ p.c. Pref. ...	1¾—3½	...
150,000	June 20	4½	4½	Do. 4½ p.c. Deb. ...	60—70	...
626,860	July 18	6	6	Cardiff Con. Ord.	118—123	...
237,860	June 3	5	5	Do. 5 p.c. Red. Deb.	105—110	...
98,936	Mar. 21	2/–	2/–	Colombo Ord....	1⅞—1¾	...
24,510	,,	1/4⅜	1/4⅜	Do. 7 p.c. Pref.... ...	23/—25/–	...
739,453	Mar. 21	–/11·48	–/11·48	Colonial Gas Assn. Ltd. Ord.	16/6—18/6	...
296,144	,,	1/3·30	1/3·30	Do. 8 p.c. Pref. ...	23/—25/–	...
1,775,005	Aug. 8	5	5	Commercial Ord.	79—84	...
140,000	,,	—	§13/4	Do. 4 p.c. Red. Pref.	97—100	...
620,001	June 3	3	3	Do. 3 p.c. Deb. ...	72—77	...
286,344	Aug. 22	5	5	Do. 5 p.c. Deb. ...	113—118*	—1
200,000	,,	—	§30/2	Do. 3½ p.c. Red. Deb.	99—102*	...
807,560	Aug. 8	7	7	Croydon sliding scale ...	135—140	...
644,590	,,	5	5	Do. max. div. ...	105—110	...
620.385	June 20	5	5	Do. 5 p.c. Deb. ...	115—120	...
239,000	Aug. 8	5	5	East Hull Ord. 5 p.c.	94—99	...
185,355	Aug. 8	6	6	East Surrey Ord. 5 p.c. ...	116—121	...
176,211	June 3	5	5	Do. 5 p.c. Deb. ...	115—120	...
250,000	July 4	4	8	Gas Consolidation Ord. 'B' ...	20/—21/–	...
250,000	May 9	4	4	Do. 4 p.c. Red. Cum. Pref.	17/6—19/6	...
19,223,324	Aug. 8	.5½	5½	Gas Light & Coke Ord. ...	23/—24/-*a*	—/3
2,600,000	,,	3½	3½	Do. 3½ p.c. max. ...	79—82	...
4,477,106	,,	4	4	Do. 4 p.c. Con. Pref....	99—102	...
2,993,000	July 4	—	3½	Do. 3½ p.c. Red. Pref....	100—103	...
8,602,497	May 23	3	3	Do. 3 p.c. Con. Deb....	82—84	...
3,642,770	,,	5	5	Do. 5 p.c. Red. Deb....	111—114	...
3,500,000	,,	4½	4½	Do. 4½ p.c. Red. Deb....	109—112	...
700,000	Mar. 7	3½	3½	Do. 3½ p.c. Red. Deb....	97½—100½	...
270,466	Aug. 22	6	6	Harrogate New Cons. ...	117—122*	—1
157,500	Mar. 21	1/2⅜	‡1/–	Hong Kong and China Ord....	⅞—1	...
213,200	Aug. 8	6	5⅝	Hornsey Con. 3½ p.c. ...	100—105	—½
5,600,000	May 9	8	12	Imperial Continental Cap ...	114—119	—4
223,130	July 18	3½	3½	Do. 3½ p.c. Red. Deb....	87—92	...
285,242	Aug. 8	8½	8½	Lea Bridge 5 p.c. Ord. ...	164—169	...
11,751	Aug. 22	10	8	Maidstone 5 p.c. Cap. ...	175—185*	...
63,480	June 20	3	3	Do. 3 p.c. Deb.... ...	70—75	...
75,000	May 23	†10	†10	Malta & Mediterranean ...	137—142	...
				Metropolitan (of Melbourne)		
392,000	Apl. 1	5½	5½	5½ p.c. Red. Deb.	99—102	...
231,977	Aug. 22	5	5	M.S. Utility 'C'-Cons. ...	99—104*	...
968,658	,,	4	4	Do. 4 p.c. Cons. Pref.	95—100*	—2

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Aug. 26.	Rise or Fall on Week.
360,075	June 20	4	4	M.S. Utility 4 p.c. Deb. ...	97—102	...
148,955	,,	5	5	Do. 5 p.c. Deb. ...	113—118	...
675,000	May 9	†6	†6	Montevideo, Ltd.	73—78	...
250,000	Aug. 8	7½	7½	North Middlesex 6 p.c. Con.	142—147	...
396,160	Aug. 8	5	5	Northampton 5 p.c. max. ...	105—110	...
300,000	Apl. 25	†9	†7	Oriental, Ltd.	147—152	...
468,537	June 3	8	8	Plymouth & Stonehouse 5 p.c.	150—155	...
621,667	Aug. 8	8½	8½	Portsmouth & Gosport Cons.	157—162	...
241,446	,,	5	5	Do. 5 p.c. max. ...	100—105	...
73,350	,,	5	5	Do. 5 p.c. Pref. ...	107—112	...
75,000	,,	4	4	Do. 4 p.c. Pref. ...	94—99	...
114,000	Aug. 8	5	5	Preston 5 p.c. Pref.	104—109	...
247,966	June 3	4	4	Primitiva 4 p.c. Cons. Deb. ...	98—103	...
625,959	July 18	4	4	Do. 4 p.c. Red. Deb. ...	94—99	...
15,000	Mar. 21	6	6	San Paulo 6 p.c. Cum. Pref. ...	8⅞—9½	...
441,275	Apl. 25	1/1½	1/1½	Severn Val. Gas Cor. Ld. Ord.	21/—22/–	...
460,810	Mar. 21	–/10½	–/10½	,, ,, 4½ p.c. Cum. Pref.	19/6—21/6	...
133,201	Aug. 22	5	8½	Shrewsbury 5 p.c. Ord. ...	127—132*	—1
9,000	June 3	4	‡4	South African Ord.	4½—5½	...
1,371,752	Aug. 22	1/2½	1/2½	South East'n Gas Cn. Ld. Ord.	22/—24/–*	...
871.636	,,	–/10½	–/10½	Do. 4½ p.c. Red. Cum. Pref.	20/—22/–*	—/6
498,818	,,	4	4	Do. 4 p.c. Cum. Pref. ...	18/—20/–*	...
450,000	Aug. 8	4	4	Do. 4 p.c. Deb.	99—102	...
150,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	94—97	...
6,709,895	Aug. 8	6	5	South Met. Ord.	105—108	...
1,135,812	,,	6	6	Do. 6 p.c. Irred. Pref. ...	128—133	...
850,000	,,	4	4	Do. 4 p.c. Irred. Pref. ...	96—99	...
1,895,445	June 20	3	3	Do. 3 p.c. Deb.	77½—80½	...
1,000,000	July 4	5	5	Do. 5 p.c. Red. Deb. ...	109—112	...
600,000	,,	—	§31/–	Do. 3½ p.c. Red. Deb. ...	99—102	...
1,543,795	Aug. 8	6	6	South Suburban Ord. 5 p.c. ...	116—121	...
512,825	,,	5	5	Do. 5 p.c. Pref.... ...	108—113	...
500,000	,,	4	4	Do. 4 p.c. Pref.... ...	94—99	...
250,000	,,	3½	3½	Do. 3½ p.c. Red. Pref. ...	97—100	...
888,587	June 3	5	5	Do. 5 p.c. Deb.	115—120	...
250,000	,,	4	4	Do. 4 p.c. Deb.... ...	96—101	...
200,000	Aug. 8	3½	3½	Do. 3½ p.c. Red. Deb. ...	93—98	...
427,859	Apl. 25	1/2½	9½	S. Western Gas & Water Ord.	15/6—17/6	—/6
160,523	,,	–/10½	–/10½	Do. 4½ p.c. Red. Cum. Pf.	19/—21/–	...
110,000	June 3	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...
750,541	Aug. 8	5½	5	Southampton Ord. 5 p.c. ...	106—111	...
148,836	June 3	4	4	Do. 4 p.c. Deb.	95—100	...
350,000	Aug. 8	5½	5½	Swansea 5½ p.c. Red. Pref. ...	106—111	...
94,000	June 3	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100	...
1,076,490	Aug. 8	6½	6½	Tottenham and District Ord.	125—130	...
409,835	,,	5½	5½	Do. 5½ p.c. Pref. ...	117—122	...
62,235	,,	5	5	Do. 5 p.c. Pref. ...	110—115	...
371,850	June 3	4	4	Do. 4 p.c. Deb. ...	96—101	...
85,701	Apl. 25	6	6	Tuscan 6 p.c. Red. Deb. ...	95—101	...
1,131,550	Aug. 22	6	4	U. Kingdom Gas Cor. Ord. ...	18/6—20/6*	...
1,051,280	May 9	4½	4½	Do. 4½ p.c. 1st Cum. Pref.	19/6—21/6	...
762,241	,,	–/1·15	4	Do. 4 p.c. 1st Red. Cum. Pf.	19/—21/–	...
745,263	June 3	4½	4½	Do. 4½ p.c. 2nd Non-Cum.Pf.	16/—18/–	...
1,000,000	Mar. 7	3½	3½	Do. 3½ p.c. Red. Deb. ...	96—99	...
373,939	Aug. 8	7	7	Uxbridge, &c., 5 p.c.	132—137	...
133,010	,,	5	5	Do. 5 p.c. Pref. ...	108—113	...
1,371,138	Aug. 8	7	7	Wandsworth Consolidated ...	135—140	...
2,525,768	,,	4	4	Do. 4 p.c. Pref. ...	96—100	...
1,343,964	June 3	5	5	Do. 5 p.c. Deb. ...	115—120	...
383,745	,,	4	4	Do. 4 p.c. Deb. ...	97—102	...
400,000	,,	—	§25/–	Do. 3½ p.c. Red Deb.	97—102	...
558,342	Aug. 8	7	6⅝	Watford and St. Albans Ord.	133—138	...
200,000	,,	5	5	Do. 5 p.c. Pref. ...	108—113	...
200,000	,,	5¼	5¼	Do. 5¼ p.c. Pref. ...	118—123	...
200,000	June 3	4	4	Do. 4 p.c. Red. Deb.	96—101	...
100,000	,,	3½	3½	Do. 3½ p.c. Red Deb.	94—99	...

a.—The quotation is per £1 of stock. * Ex. div. † Paid free of income-tax. ‡ For year. § Actual.

Supplementary List and Provincial Exchanges overleaf.

STOCK AND SHARE LIST—Cont.

Supplementary List, not Officially Quoted, London

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Nominal Quotations Aug. 26.	Rise or Fall on Week.
202,152	Mar. 21	5	5	Ascot Ord.	103—108	...
128,182	July 18	5	5	Do. 5 p.c. Pref.	108—113	...
31,035	Aug. 22	–/4⅛	–/4⅛	Associated Utilities 4 p.c. Pref.	16/—18/–*	...
100,000	Dec. 13	...	3½	Do. 3½ p.c. Red. Deb. ...	95—100	...
17,000	Aug. 22	8	8	Bognor Orig. Ord. 'A' ...	155—165*	...
62,210	,,	8	8	Do. New Addl. 'A' ...	155—165*	...
87,160	,,	7	7	Do. New 7 p.c. max. ...	150—160*	...
37,440	Aug. 8	10	10	Cam. Univ. & Town 10 p.c. max.	188—198	...
125,970	,,	7	7	Do. 7 p.c. max.	133—138	...
39,025	,,	5	5	Do. 5 p.c. max.	97—102	...
96,410	July 18	4½	4½	Cardiff 4½ p.c. Pref.	95—100	...
150,000	Aug. 8	4	4	Croydon 4 p.c. Pref.	97—100	...
130,000	June 20	4	4	Do. 4 p.c. Deb.	97—102	...
65,000	Aug. 8	8½	7½	Eastbourne 'A' 5 p.c. ...	140—145	—½
198,000	,,	7	6	Do. 'B' 3½ p.c.	115—120	—2½
112,312	,,	5	5	Do. 5 p.c. Pref.	107—112	...
130,000	June 20	5	5	Do. 5 p.c. Deb.	112—117	...
24,000	Aug. 8	8½	8½	Great Yarmouth 8½ p.c. max.	43—48	...
59,400	,,	7½	7½	Do. 7½ p.c. max.	33—38	...
51,160	June 3	5½	5½	Do. 5½ p.c. Deb.	121—126	...
152,600	Feb. 21	8	9	Guildford Cons.	167—172	...
54,055	,,	5	5	Do. 5 p.c. Pref.	108—113	...
68,250	June 20	5	5	Do. 5 p.c. Deb	107—112	...
156,600	Aug. 22	7½	7½	Hampton Court Cons. ...	131—136*	—7
80,000	Aug. 8	4	4	Lea Bridge 4 p.c. Pref. ...	94—99	...
60,000	,,	6	6	Do. 6 p.c. Pref.	121—126	...
94,876	June 3	4	4	Do. 4 p.c. Deb.	95—100	...
73,620	Mar. 7	8⅛	8⅛	Luton Cons. 'A'	155—165	...
107,960	Mar. 21	4	5⅛	Mid Kent Ord.	8⅛—9⅛	...
230,940	Aug. 8	10	10	Oxford & District Ord. ...	195—200	...
47,112	,,	5	5	Do. 5 p.c. Pref.	106—111	...
50,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	107—112	...
126,193	May 9	7½	7½	Peterborough Ord.	135—145	...
64,990	Mar. 7	6½	7½	Redditch Ord.	120—130	...
166,850	Aug. 8	8	8	Romford Ord.	142—147	...
60,000	,,	4	4	Do. 4 p.c. Pref.	97—100	...
44,000	Mar. 21	5	5	Do. 5 p.c. Deb.	111—116	...
25,570	Aug. 8	5½	5½	Rugby 5½ p.c. Pref.	120—125	...
25,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	104—109	...
42,750	June 3	5½	5½	Do. 5½ p.c. Deb.	118—123	...
110,950	Aug. 22	8	8	Ryde Ord.	140—150*	...
270,086	Mar. 21	7	7	Slough Ord.	128—133	...
21,000	June 20	5	5	Do. 5 p.c. Deb.	110—115	...
28,872	May 9	5½	5½	S. Midland Gas Cpn. Ltd. Ord.	19/—21/–	...
28,866	Mar. 7	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	18/6—20/6	...
117,228	Aug. 8	7	5	Swindon Cons.	102—107	...
60,425	June 3	5	5	Do. 5 p.c. Deb.	112—117	...
64,380	June 3	5	5	Torquay & Paignton 5 p.c. Pref.	107—112	...
130,000	Aug. 8	8	5	Wakefield Ord.	116—121	...
81,650	,,	5	5	Do. 5 p.c. max.	100—105	...
82,000	Aug. 8	6	6	Weymouth Ord.	103—108	...
98,384	Aug 22	6	6	Wolverhampton 6 p.c. Pref.	118—123*	...
160,000	June 20	5½	5½	Do. 5½ p.c. Rd. Db.	105—110	...
90,000	June 20	5	5	York 5 p.c. Red. Deb. ...	104—109	...
133,640	July 18	6½	6½	Yorktown (Cam.) 5 p.c. Cons.	118—123	...
120,000	,,	5	5	Do. 5 p.c. Pref.	105—110	...
35,000	June 3	5½	5½	Do. 5½ p.c. Deb.	120—125	...

BRISTOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Aug 26.	Rise or Fall on Week.
347,756	July 18	6	5	Bath Cons.	118—120	...
1,667,250	July 18	5	5	Bristol, 5 p.c. max.	112—114	+1
120,420	June 3	4	4	Do. 1st 4 p.c. Deb. ...	101—103	...
217,870	,,	4	4	Do. 2nd 4 p.c. Deb. ...	101—103	...
328,790	,,	5	5	Do. 5 p.c. Deb.	119—122	...
274,000	Aug. 8	5	5	Newport (Mon). 5 p.c. max....	97—99	...
13,200	Mar. 21	7	8½	Pontyp'l Gas & W. 10 p.c. 'A'	13—14	...
13,600	,,	5	6	Do. 7 p.c. 'B'	12—12½	...
40,000	,,	5	6	Do. 7 p.c. 'C'	12—12½	...
140,778	Aug. 8	5	5	Weston-super-Mare Cons. ...	108—110	...
64,338	June 20	4	4	Do. 4 p.c. Deb.	100—102	+1
33,340	,,	7½	7½	Do. 7½ p.c. Deb.	151—154	...

LIVERPOOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Aug 26.	Rise or Fall on Week.
157,150	Aug. 8	6½	5	Chester 5 p.c. Ord.	107—110	...
92,500	June 20	4	4	Do. 4 p.c. Pref.	95—99	...
36,430	,,	3½	3½	Do. 3½ p.c. Deb.	87—90	...
41,890	,,	4	4	Do. 4 p.c. Red. Deb. ...	97—101	...
2,167,410	Aug. 22	6	6	Liverpool 5 p.c. Ord.... ...	122½—124½	—1½
245,500	June 20	5	5	Do. 5 p.c. Red. Pref. ...	97—102	...
306,083	July 18	4	4	Do. 4 p.c. Deb.... ...	100—102	...
106,280	Aug. 8	10	10	Preston 'A' 10 p.c.	198—208	...
188,219	,,	7	7	Do. 'B' 7 p.c.	131—141	...

NEWCASTLE EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Aug 26.	Rise or Fall on Week.
122,577	Aug. 8	8	8	Blyth 5 p.c. Ord.	161—162	...
732,000	Aug. 22	5	5	Hartlepool G. & W. Cn. & New	108¾—109¾*	—½
2,061,315	Aug. 8	5½	5	Newcastle & Gateshead Con.	23/3—23/9d	—/1½
682,856	,,	4	4	Do. 4 p.c. Pref. ...	99—100	...
776,706	June 20	3½	3½	Do. 3½ p.c. Deb. ...	88½—89½	...
277,285	May 9	5	5	Do. 5 p.c. Deb. '43 ...	104—106	...
332,351	Aug. 22	6	6	Sunderland 6 p.c. max. ...	135—136*	—2½

NOTTINGHAM EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Aug 26.	Rise or Fall on Week.
542,270	Aug. 8	9	6	Derby Con.	133—143	...
55,000	June 3	4	4	Do. 4 p.c. Deb.	100—105	...
20,000	June 20	5	5	Long Eaton 5 p.c. Pref. ...	10—12	...
80,000	,,	5	5	Do. 5 p.c. Deb. ...	105—110	...

SHEFFIELD EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Aug 26.	Rise or Fall on Week.
10,000	Aug. 8	10	10	Great Grimsby 'A' Ord. ...	205—215	...
6,500	,,	10	10	Do. 'B' Ord. ...	205—215	...
79,000	,,	10	10	Do. 'C' Ord.. ...	195—205	...
1,806,339	Aug. 22	6½	6½	Sheffield Cons.	139—141*	—1½
95,000	July 4	4	4	Do. 4 p.c. Deb.	101—103	...

a The quotation is per £1 of Stock. * Ex div.

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